VOL. 21, NO. 4 December, 1946

THE QUARTERLY REVIEW of BIOLOGY

THE EPITHELIONEURAL BODIES

By ERNEST VAN CAMPENHOUT
Institute of Anatomy, University of Louvain

VARIOUS microscopic structures are characterized by an intimate or intricate association of epithelial cells and neural elements. These mixed structures I propose to designate as epithelioneural bodies. The degree of intimacy of this relationship between the two cellular types varies enormously. In some instances, there is a true mixture of epithelial and neural elements without any topographic demarcation. There may be an intimate contiguity of the two cellular types inside a common connective tissue capsule. Sometimes, there is only a localization of epithelial cells in nerve trunks, between the nerve fibers. In all these instances, there is a true association between epithelial cells and neural elements; an association much closer than a mere pericellular or intercellular nervous ending. As an example of this distinction, the neuro-epithelial sensory cells of the vestibular or cochlear organs should not be considered as epithelioneural bodies, in spite of their being partially surrounded by nerve fibers.

The term epithelioneural has been chosen in order to prevent terminological difficulties and misunderstandings. The similar term neuro-epithelium is already used with various meanings: it is used to describe the wall of the embryonic neural tube; or to characterize the sensory cells, differentiated in various epithelia, that receive chemical or mechanical stimuli in order to send them, as nervous impulses, along the contiguous nerve fibers. Many authors speak of the olfactory neuro-epithelium in dealing with the olfactory placode, which contains true nerve cells possessing true neurites. Thus, in order to avoid further confusion, the term "epithelioneural associations" will hereafter be used to refer to typical complexes of epithelial and neural elements.

Objection might be raised to this emphatic distinction between the epithelioneural bodies and the pericellular nerve endings on the ground that it is somewhat artificial and might merely represent a quantitative difference, and not an essential one. True, a more or less voluminous epithelioneural body might be considered as an accumulation of a large number of contiguous units, each one representing a connection between one epithelial cell and one nerve ending. However, the fact that this grouping of epithelioneural relationships in bodies is only found in definite areas deserves particular consideration. Furthermore, the epithelioneural bodies are frequently associated with ganglionic cells. Lastly, in many instances, there occur in these bodies cytological transformations of the epithelial cells, which become more or less similar to authentic nerve cells. For all these reasons, we consider it advisable to group these structures under one heading, even if, later on, unicellular epithelioneural connections are also included in this group.

We shall consider in succession the various structures which show this mixed, epithelioneural constitution: first a study of the paraganglia and the structures which are, rightly or wrongly, considered as paraganglionic in nature; then, the neuro-entoblastic complexes; and lastly, the

BOSTON UNIVERSITY
COLLEGE OF LIBERAL ARTS
LIBRARY

neuro-mesoblastic bodies. Various criticisms of the facts presented or their significance will be pointed out where they are pertinent.

I. THE PARAGANGLIA

Since Kohn (1903) suggested the term "paraganglion" to designate various multicellular formations derived from the ganglionic crest and localized in the trunk region of certain mammalian embryos (man, cat, rabbit), numerous workers have studied these structures. They are characterized by two main features, one, their origin from the trunk ganglionic crest, the other, their chromaffin reaction (Henle's reaction), i.e., the brown staining of their cytoplasmic granules after potassium bichromate fixation. The actual value of these two criteria is very unequal.

In order to ascertain the origin of the paraganglia from the ganglionic crest, it is obvious that careful embryological studies based on a series of embryos can alone give an adequate answer. This combined embryological and histogenetic phase of the study is of primary importance, since it is the neurectoblastic origin of these epithelial cells that constitutes the main source of interest in these bodies as far as their morphological significance is concerned. In his fundamental work, Kohn rightly emphasized the fact that the paraganglia are genetically and anatomically bound to the sympathetic nervous system and that they maintain these intimate relations. It should of course be borne in mind that in 1903 the word "sympathetic" had a meaning which is not identical with that given it at the present time. It then designated what we now call the thoracolumbar autonomic nervous system, the origin of which is considered to be mainly from the trunk ganglionic crest.

To use the word "paraganglion" without having ascertained the origin of the epithelial cells involved is very unwise, to say the least, and leads to confusion. Instead of considering this as a postulate, many authors unquestioningly accept it as though it were a demonstrated fact and use the term without ever investigating the origin of the structures they label.

The actual value and significance of the second criterion proposed by Kohn have been widely discussed; the greater part of this discussion is now of historical interest only. It is well known to-day (Gérard, Cordier, and Lison, 1930) that the so-called chromaffin or pheochrom reaction is not just a staining of cytoplasmic granules by chrome salts, but is the result of the oxidation of a certain amount of adrenalin into its corresponding quinone, together with the formation of a colored intermediate product. These workers have shown that a positive Henle's reaction can be obtained in the medullary zone of the adrenals after fixation in a formaldehyde solution containing sodium or potassium iodate. With the restrictions formulated by Lison, this modified Henle's reaction proves the existence of phenolic components of the adrenalin type in the cytoplasm. The term "chromaffin reaction" should be replaced by "reaction of Henle," since one can use chromium salts or iodates indifferently.

What, then, is the value of Henle's reaction in so far as the identification of paraganglionic elements is concerned?

It is a fact well known among histologists that the reaction of Henle gives irregular results. In authentic paraganglia, such as the medullary zone of the adrenal glands in mammals, the degree of brown staining differs from one cell to another, and many cells may be colorless. This variability is observed after potassium bichromate fixation as well as after sodium iodate fixation, and it evidently corresponds to variations in the amount of adrenalin-like substances in the cytoplasm. One might assume a secretory cycle with an alternate succession of loading phases and excretion phases, as Stoerk and Haberer (1908) have shown that the glandular cycle of the chromaffin cell involves an initial non-chromaffin stage. Or a negative reaction might be the result of a massive excretion of adrenalin at the death of the animal, such as has been observed after various kinds of nervous stimulation. The positivity of the reaction decreases rapidly after death, the shorter the interval between death and histological fixation, the better being the result of Henle's reaction. Even in the best possible conditions of fixation for Henle's reaction, many cells of the medullary zone of the adrenals remain colorless.

On the other hand, Henle's reaction may give positive results, i.e., a brown staining of the cytoplasmic granules, in cells which are not derived from the ganglionic crest. The Kulchitzky cells of the gastro-intestinal tract, for example, give a positive reaction, in addition to their silver-reducing and silver-fixing properties. But these cells differentiate *in situ* from intestinal

epithelial cells which, prior to their differentiation as true Kulchitzky elements, do not seem to be different from contiguous cells. The reaction of Henle is therefore positive in cells originating from the entoblast, and chromaffin elements are not necessarily of ganglionic crest origin. It might be supposed that the cells of Kulchitzky (also called silver-reducing cells or enterochromaffin cells) have their origin in cellular elements which, in younger stages of embryonic development, have migrated from the ganglionic crest and have penetrated into the intestinal epithelium. There is, however, not a single observation supporting this view. On the contrary, Simard and Van Campenhout (1932) have shown that, in the chick, the silver-reducing cells of the intestinal epithelium appear in chorio-allantoic grafts, even when the entoblastic epithelium is taken from an embryo in which no migration of ganglionic crest cells could have taken place. These enterochromaffin cells have therefore a local origin; they do not arise from elements migrating from the neural crest into the epithelium. In these experiments, the test for Kulchitzky cells was the argentaffin (silver-fixing) reaction. It has been shown repeatedly that all cells giving a positive Henle's reaction are argentaffin, although the reverse is not true.

From the foregoing considerations, it is to be concluded that, in true paraganglionic cells, the reaction of Henle gives variable results, sometimes entirely negative; whereas the same reaction is positive in certain cells which are not derived from the ganglionic crest at all. There thus appears to be a certain discrepancy between the significance of the two criteria upon which the identification of paraganglionic tissue has been based. Since the results of Henle's reaction are variable, it is not to be depended on, and emphasis should be placed upon the second criterion, that of the embryological origin.

Among the numerous workers who have studied the embryogenesis and histogenetic development of the paraganglionic tissue, Poll (1906), Zuckerkandl (1912), Celestino da Costa (1917), Goormaghtigh (1921), and de Winiwarter (1924) made outstanding contributions. There were, to be sure, a few workers whose opinions were at variance with the classical descriptions,—those, for instance, who favored a mesoblastic origin of the paraganglionic cells and of the sympathetic nervous system. But actually, the question appears to have been unanimously settled (cf. Van Campenhout, 1930a). The suprarenal organs of lower vertebrates and the medullary zone of the adrenals of mammals are derived from the ganglionic crest, and are enormous paraganglia entirely identical in nature to the series of smaller paraganglia scattered all along the aorta, of which the organ of Zuckerkandl, at the origin of the inferior mesenteric artery, is but a temporary accumulation. The neurectoblastic origin of the paraganglionic part of the adrenals in amphibian embryos has been demonstrated experimentally (Van Campenhout, 1930b). Extirpation of the trunk ganglionic crest prevents the formation of the spinal ganglia, the prevertebral sympathetic ganglia, and the suprarenal elements.

Such was the state of knowledge concerning the paraganglia, when a few authors described groups of epithelial cells found along or in the branches of the vagus nerves in the cervical region (de Winiwarter, 1934), in the heart pedicle (Muratori, 1932; Penitschka, 1931; Palma, 1934; Goormaghtigh and Pannier, 1939), in the gastro-hepatic region (Goormaghtigh, 1936). These intra- or juxta-vagal formations consist of epithelial cells possessing a nucleus with dusty chromatin and a poorly stainable trabecular or vacuolar cytoplasm. Their localization and cytological characters are somewhat similar to those of typical paraganglionic tissue, and they have been called by a few authors "vagal paraganglia." The choice of this term is most unfortunate.

Even should one concede that Kohn's paraganglia are the true, authentic paraganglia, whereas the vagal ones are pseudoparaganglia, still confusion is inevitable and brings misunderstandings and errors in its train. A striking example of this, completely misleading the reader, can be found in the outstanding contribution of Goormaghtigh and Pannier (1939) on the paraganglia of the heart pedicle in the cat. In discussing the possible significance of their "vagal paraganglia," these authors state (p. 458) that these bodies originate in the ganglionic crest, since Van Campenhout "par la destruction des crêtes neurales obtient des larves d'Amphibiens dépourvues de système sympathique, de médullo-surrénale et de tissu paraganglionnaire." Simply by leaving out the word "true" or "vagal" these workers make me responsible for a demonstration that was never made. It was only shown experimentally that the suprarenals in amphibians, i.e.,

true paraganglia, originate from the ganglionic crest; and it was stated that after removal of the neural crest the cellular masses representing the chromaffin primordia are lacking; but the origin of the epithelial bodies found along the vagus nerves was not demonstrated, and still remains unknown. De Winiwarter, very prudently regards these epithelial cells as derived from undifferentiated cells located in the nerve trunks and representing sympathoblasts scattered in the cerebrospinal nerves.

To use the term "paraganglion" without any embryological data involves a postulate and ought to be avoided. Disagreeing with Goormaghtigh, I regard the concept of "vagal paraganglia" as only an hypothesis. Until the neurectoblastic origin of these intra- or juxtavagal epithelial bodies has been demonstrated, a healthy scepticism will have the merit of stimulating further investigation in this interesting field. In the meantime, we will simply consider them as epithelioneural bodies, the nerve fibers being most likely vagal, the epithelial cells being of unknown origin.

The intravagal epithelioneural bodies do not give a positive reaction of Henle. This negative reaction is assumed to result from the fact that these cells do not form adrenalin but elaborate acetylcholine. According to this hypothesis, the vagal epithelioneural bodies play in relation to the parasympathetic nervous system a role similar to the one played by the paraganglia in relation to the orthosympathetic nervous system. In favor of such a view, we mention here only the observations of Christie (1933), who has extracted from a tumor of the glomus caroticum a vasodepressor substance which differs in its properties from acetylcholine. If the epithelial components of these bodies are effectively secretory cells, which has not been demonstrated but might be inferred from their rich blood supply, it would be logical to deduce the secretion of a substance acting on the vagus nerve, i.e., on the parasympathetic component of this nerve. A secretion of adrenalin in the vagus nerves would be surprising, since it has been shown that adrenalin liberation characterizes the last orthosympathetic synapsis. It is however worth mentioning that the physiological importance of acetylcholine is still a matter of controversy. In a recent paper of Heymans, Bouckaert and Pannier (1943) we read, for instance, that various experimental facts speak against the role of acetylcholine in the stimulation of chemoreceptors. The suggestion of Goormaghtigh (1936) "that the non-chromaffin paraganglia associated with the vagus should contain and liberate acetylcholine" is not supported by the actually known facts.

While we discuss the significance of the intravagal epithelioneural bodies, it should be borne in mind that in young stages of development the ganglion nodosum of the pneumogastric nerve and the superior ganglion of the cervical sympathetic chain are intimately related and exchange anastomoses. Orthosympathetic cells may thus pass into the ganglion nodosum, and orthosympathetic fibers will run in the vagus nerves. One might therefore suggest, as de Winiwarter does, that undifferentiated cells or sympathoblasts arising in the sympathetic chain are able to migrate into the vagus trunks and show a later differentiation into authentic paraganglionic cells. The negative Henle's reaction might then be accidental, as may be the case for typical paraganglionic cells; or it might be the result of the absence of adequate nervous stimuli, i.e., orthosympathetic; or it might be caused by an inhibitory stimulus derived from the parasympathetic fibers of the vagus nerves.

One should also not forget that Henle's reaction may give results which vary according to the age of the animal. Celestino da Costa (1939) is of the opinion that the "non-chromaffin paraganglia" are cellular formations of unknown origin, the differentiation of which is not yet completed. This worker, whose opinion in this field is most valuable, considers that non-chromaffin elements remaining as such for a certain length of time may become chromaffin as the animal becomes older; and he describes heart paraganglia of which the chromaffinity appears only in late adult stages. This concept of a late differentiation of cells and of a stock of reserve elements is supported by the observations of Blotevogel, which show that in the juxtagonadic paraganglia the number of chromaffin cells increases during pregnancy without any sign of cellular multiplication, so that non-chromaffin elements must differentiate into chromaffin cells. The observations and interpretations of Celestino da Costa indicate that the mere observation of a negative Henle's reaction is not a sufficient ground for considering these epithelial intravagal formations as a new type of structure. In spite of their

intravagal location, these epithelial bodies might be authentic paraganglia, the differentiation of which had been delayed.

On the other hand, the distinction between true paraganglia and the so-called "vagal paraganglia" is supported by other features than nonchromaffinity. The latter bodies form compact structures, sometimes lobulated, of a comparatively large size, whereas the paraganglia present a more scattered arrangement; their cells are more uniform in size; the chromatin network stains more deeply; there is more uniformity in the size of the nuclei, which average 5.7 microns whereas those of the paraganglia average 5.5 microns; finally, their relation to nerve trunks is closer than that of the paraganglia. These distinctions would be of much greater significance had a difference in origin been previously demonstrated; as it is, they hardly prove a difference of origin. Is there in fact a more compact structure than the medullary zone of the adrenals, which is a true paraganglion? Could not uniformity in size be related to a lesser degree of differentiation? Is the average difference of two tenths of a micron between the sizes of the nuclei really significant? Is the relationship to the nerves really more intimate, since, as we shall see later, numerous paraganglia and various epithelioneural bodies of entoblastic origin show a typical imbedding in the nerve trunks?

From this review of our actual knowledge about the intravagal epithelioneural bodies, to which we will return later, it is obvious that a considerable amount of work will still be necessary in order to elucidate their significance. Their embryological origin, their distribution in various animals, and their physiological role are yet unsolved problems. The known facts do not support their being considered as paraganglia. Kohn's actual classification of two types of paraganglia (1929) is based only on the results of Henle's reaction and on the location of the structures; he has neglected the most important criterion of paraganglionic tissue, its genetic relationship to the neural crest. This distinction will be further considered at a later point.

The glomus caroticum

The origin, histological structure, and physiological role of the glomus caroticum, otherwise called the paraganglion caroticum, carotid body, or carotid gland, have been widely discussed, but no agreement has been reached, even as to its essential features. Only a few recent papers, in which more extensive historical and bibliographical data can be found, will be reviewed here.

Benoit (1928) describes the first appearance of the carotid body as one of cellular bands of poorly differentiated elements derived from the vagospinal complex. These bands reach the mesenchymatous sheath surrounding the carotid artery in the region of the third aortic arch. As the orthosympathetic nervous system makes no contribution, the chromaffin reaction should be negative.

In 1934, Hammar described the mesenchymal origin of the carotid body. Into the primordium, cellular bands originating in the glossopharyngeal nerve break their way; later, similar strands arise from the pneumogastric nerves and from the cervical sympathetic chains. Numerous nerve fibers as well as ganglionic cells find their way between the epithelial cells, which are considered to be secretory in nature.

According to Watzka (1934), the epithelial cells of the paraganglion caroticum are paraganglionic cells originating from the neighboring nerves and secondarily penetrating into the mesenchymal condensation around the internal carotid artery. In a short paper, Szepsenwohl (1935) described a few cells of the ganglion caroticum as originating from epiblastic placodes.

De Winiwarter (1938) showed that the primary phenonemon in the development of the glomus caroticum is the formation of the artery. The peri-arterial sheath becomes progressively hypertrophied. It consists at first of mesenchymal elements. Later it receives elements derived from the epiblast, neural elements arising in the petrosal ganglion of the glossopharyngeal nerve, and even elements migrating out of the hypoblastic epithelium. In late stages of development, paraganglionic cells also appear in this complex anlagen, a fact supporting the description of Watzka but denied by Celestino da Costa.

From this review of recent publications, it may be safely concluded that the glomus caroticum arises as a mesenchymal structure into which there migrate elements originating from various sources, the glossopharyngeal and pneumogastric nerves, the sympathetic chains, the epiblast, and even the hypoblast.

The rich innervation of the glomus caroticum has been described by many workers, particularly by De Castro (1928), by Riegele (1928), and by

Nonidez (1935, 1936). These nerve fibers are doubtless sensory in function, with their cell bodies located in the petrosal ganglion. The fibers surround the epithelial cells by an enclosing network, the endings of which might eventually (Nonidez) become intraprotoplasmic.

The most recent histological contribution has been published by Meijling (1938), who has described the epithelial cells of the glomus caroticum in the horse as true nerve cells. Using the silver-impregnation methods of Bielchowsky, this author described a filamentous structure of the cytoplasm as formed by neurofibrils. With the supposedly specific methylgreen-pyronin technique, he also observed cytoplasmic inclusions which he considered to be Nissl bodies. Meijling's illustrations are quite convincing. Yet he admits that all the impregnations do not show the neurofibrillar structure and that the facts are much less convincing in both the pig and the cat. One might cast doubt upon the specificity of the methylgreen-pyronin method, for, as de Winiwarter points out, this method stains red other inclusions, in, for instance, the hepatic cells. The second part of Meijling's demonstration then becomes very weak, and only the neurofibrillar structure signifies the neural nature of these cells. The latter fact being nevertheless indisputable, the cells of the glomus caroticum of the horse must be regarded as neural elements. These nerve cells form a true syncytium by means of wide protoplasmic bridges. Nor ought this to be considered an objection to the neural nature of the elements concerned, for, as Meijling has pointed out, true interneuronic anastomoses have been described in the coeliac ganglion of the horse, in the post-hepatic intestine of *Amphioxus*, and in the sympathetic ganglia of the frog.

It has already been mentioned that the paraganglionic nature of the cells found in the glomus caroticum had been suggested by Watzka and by de Winiwarter. It was denied by Celestino da Costa mainly because of the negative chromaffin reaction, by Gosses because its cellular arrangement is different from that found in the paraganglia, and by Benoit, who described the origin of these cells from the vago-spinal trunk whereas paraganglionic cells are derived from the orthosympathetic chains. Since Kohn specified that the paraganglia are not nervous in structure whereas Meijling's observations revealed a typically nervous structure of the glomus caroticum, this organ ought logically not to be regarded as a paraganglion. Meijling further questioned the validity of maintaining the concept of the paraganglion proposed by Kohn, and based his attitude on the fact that a cellular mass identified by ordinary histological techniques as a paraganglion of the vagosympathetic chain, was, after silver impregnation, seen to be formed of typical nerve cells with neurofibrillar cytoplasmic networks.

As a working hypothesis, one might suggest that the paraganglia, or a certain number of them, are nervous in nature, their neural structure being ascertainable only through the use of silver impregnation methods. It is well known that authentic nerve cells, typical ganglionic cells, are frequently found in the paraganglia and in the medullary zone of the adrenals, although they are few in number. On the other hand, Gaskell's observations have shown, in the leech, the existence of chromaffin granules in the cytoplasm of typical ganglionic cells. No sharp demarcation should therefore be drawn between the ganglionic cell and the chromaffin cell. Acceptance of this viewpoint requires further substantiation. Old observations by Smirnow (1890), Fusari (1891), and Dogiel (1894) showed that in the prevertebral paraganglia and in the medullary zone of the adrenals there are intimate connections between the epithelial cells and the sometimes varicose nerve fibers which frequently penetrate into the cytoplasm of the epithelial cells. More recently, Pines (1924) has emphasized the wealth of the innervation of the chromaffin cells in the paraganglia; Kolossow (1930) admitted that nerve fibers penetrate the cells of the medullary zone of the adrenals, while Stöhr (1935) showed the existence of a neural terminal reticulum on the surface of the chromaffin cells of the adrenals. The relationship between the intracellular nerve endings described by various authors and the neurofibrillar structure shown by Meijling is still uncertain.

As to function, the glomus caroticum is at present regarded as a sensory center located along the arterial system. The syncytium of small nerve cells, described by Meijling, on this view would be in synaptic relationship with afferent nerve fibers through pericellular endings. According to this author, the presence of acetylcholine, or other substances more or less related to it, in extracts of the glomus caroticum or its tumors (Christie) should not be considered as a crucial demonstration of the secretory role of its constituent cells, for it would inevitably result from

the transfer of the nerve impulses through synaptic articulations. Besides, Cannon and Rosenbluth (1937) have shown that stimulation of the preganglionic fibers going to a prevertebral autonomic ganglion causes liberation of acetylcholine; Chang and Gaddum (1933) have extracted acetylcholine from various tissues and from the prevertebral cervical sympathetic chains.

The coccygeal glomus

The coccygeal gland or coccygeal glomus was described by Luschka in 1860 and 1868. Arnold (1867) studied the coccygeal glomeruli in various mammals. They occur only in the distal end of the tail, in a region where the ventral arch of the vertebra is absent, i.e., posterior to the eighth caudal vertebra in the dog and cat and posterior to the fourteenth caudal vertebra in the rat and mouse. In 1906, Stoerk established the fact that the cells of the coccygeal gland never give a positive chromaffin reaction and that they are in intimate histogenetic relationship with the sympathetic chains and with the middle sacral artery.

The most outstanding work on these bodies was made by von Schumacher (1908), who described the identity of the coccygeal glomus of man and the caudal glomeruli of tailed mmmals. Both are arteriovenous anastomoses, the thick wall of which shows numerous muscular epithelioid cells and is lacking in elastic fibers. In following the afferent artery, one sees its musculature becoming progressively modified, its cells becoming shorter and wider and their rod-shaped nuclei spherical and less chromatic. The epithelioid cells of these organs are therefore to be considered as modified smooth muscle cells. This histologic description is in complete agreement with the embryogenesis of the glomus, which arises as a localized thickening of the wall of the middle sacral artery and of its ventral branches. The epithelioid cells are probably contractile, since the vessels are sometimes wide open, sometimes entirely closed. Between these cells nerve fibers are present, but they are very few in number.

In a recent publication (1938), von Schumacher has emphasized the great similarity, and even identity, of the cells found in the coccygeal glomus with those found in the glomus caroticum. According to him, the coccygeal glomus, the glomus caroticum, the caudal glomeruli, the aortic glomus, the cardiac glomus, and the so-called "vagal paraganglia" are not paraganglionic in nature. They are all aggregations of arteriovenous anastomoses, and their epithelial cells are modified smooth muscle cells. Nevertheless, von Schumacher admits that these modified myoblasts may become secretory cells and may possibly secrete acetylcholine into the vascular lumen. It is of course difficult to reconcile this "unifying" attitude with all the known facts concerning the development and the structure of these various organs.

Hollinshead (1941), on the contrary, lays stress on the differences between the coccygeal and the carotid glomi. In the glomus caroticum, the cells are much richer in mitochondria than the cells of the coccygeal glomus, and are in much closer relationship with the vessels than in the latter. An abundant nerve plexus surrounds the cells of the glomus caroticum, whereas no such plexus has been found around the epithelial cells of the coccygeal glomus.

There is no real evidence in support of the paraganglionic nature of the coccygeal body. It is, however, probable that the structure of this organ has not yet been fully ascertained.

The aortic glomus

The aortic glomus (or supracardiac organ of Penitschka) is, according to the studies of Penitschka (1931) and of Goormaghtigh and Pannier (1939), formed as a subcutaneous glomus to which a paraganglionic component has been added. These paraganglionic cells give a positive reaction of Henle, and they are surrounded by a collagenous capsule that presents along its deep surface small, elongated cells similar to the capsular cells of ganglionic elements. These paraganglionic cells show a short arm-like prolongation that is perhaps homologous to the origin of an axis cylinder. Besides this supracardiac organ of Penitschka, which is at one and the same time a glomus and a paraganglion, Goormaghtigh and Pannier have described in the cat numerous cellular masses located in the epicardium of the aortico-pulmonary area. They are not glomic in structure; some are chromaffin, some are not, and some show a mixture of chromaffin and non-chromaffin elements. The first are presumably in relation with the orthosympathetic fibers, the second with vagus fibers, and the mixed elements simultaneously with vagal and orthosympathetic fibers.

This distinction between three types of paraganglia is but a reduplication of the classification published by Watzka in 1934, which is of question-

able value, inasmuch as the descriptions of Celestino da Costa showed that paraganglionic cells may sometimes become chromaffin at a very late stage of life and that a stock of non-chromaffin elements may be found in various paraganglia. We have already pointed out the fact that in the medullary zone of the adrenals certain areas are variably rich in chromaffin elements, many cells remaining entirely colorless after bichromate fixation. The same variability can be observed with silver staining, in the argentaffin reaction, which should of course not be regarded as a silver-reducing reaction. Argentaffinity is much more easily observable than the brownish chromaffin reaction given by the bichromate or iodate fixations.

The presence of an outgrowing process on the cells of the aortic glomus and the presence of a capsule of flat cells similar to the capsular elements of the ganglionic cells are the most interesting observations published by Goormaghtigh and Pannier. They lead us, along the lines indicated by Meijling, to the conception of the glomus cells as neural in nature. It should be pointed out that the existence of this cellular process gives to the glomus cells a somewhat racket-like shape, which is one of the characteristic aspects of the muscular cells in the cutaneous glomus, as described by Masson (1937). Since the same cell may be chromaffin and possess a cellular outgrowth, such a cell should be considered identical with the cells described by Gaskell (1916) in *Hirudo*, being both ganglionic and chromaffin. This provides us with two instances of organs that show a neural structure not suspected when ordinary techniques were used. One is the glomus caroticum, with non-chromaffin elements possing a neurofibrillar structure. The other is the glomus aorticum of Penitschka, with chromaffin cells that possess an axone-like process and a capsule. It is evident that Meijling's suggestion is promising for understanding the significance of paraganglionic tissue and of a few more or less related epithelioneural bodies.

Other possible paraganglia

There exist a few organs, the significance of which is still enigmatic, certain workers regarding them as paraganglia, others as of a glomic nature: the tympanic organ of Mullon, the intraorbital ganglion of Botar and Pribec (1935), the jugular glomus of Guild (1941). Our knowledge of these is so scanty that we are limited to a mere mention of them.

The pituitary gland, which is a juxtaposition of a neural derivative and a stomodaeal outgrowth, might be regarded as belonging in this category of epithelioneural associations. In its formation, of course, epithelial cells migrate from the anterior or from the intermediate lobe into the neural lobe. But since there is no real interpenetration of epithelial and neural elements, such as characterizes the epithelioneural bodies, it seems best to exclude the pituitary from the true epithelioneural associations.

II. THE NEURO-ENTOBLASTIC COMPLEXES

Four types of complex structures that consist of epithelial cells arising from the embryonic entoblast and of neural elements are known. They are to be found in the pancreas of mammalian embryos, in the human vermiform appendix, in the hilus of the liver, and in the duodenum of the cow embryo.

The sympathetico-insular complexes of the pancreas

In 1925, and again in 1927, Van Campenhout studied the histogenesis of the pancreas in a series of mammals (sheep, dog, mouse, calf, guinea-pig, *Dendrohyrax*, and man) and described the formation of typical epithelioneural associations which he called "complexes sympathico-insulaires." From a slide shown me by Professor Peyron in 1926, I know that these complexes also exist in the goat, while their existence in the horse has been verified in slides furnished by Professor Masson in 1931. There are, then, nine mammals in all in which these structures have been observed in the embryonic pancreas. It is highly probable that similar structures could be found in all mammalian embryos.

The first generation of endocrine islets appearing in the course of the histogenetic development of the pancreas, that which originates from the primary pancreatic tubes, is characterized by this curious association of insular and ganglionic elements. It involves not only a contiguity, a juxtaposition of the two cellular types, but represents a true interpenetration of the two components, an intimate and apparently irregular mingling of the two cellular types (see Figs. 1, 2).

This close relationship between the insular and the ganglionic elements may arise through various steps. In sheep and in man, the primary island, also called the island of Laguesse, is a localized swelling of the wall of the primary tube. This thickening enlarges progressively until it is only connected with the wall of the tube by a pedicle

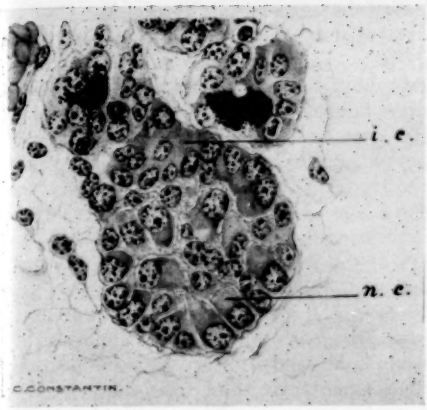


FIG. 1. A SYMPATHETICO-INSULAR COMPLEX IN THE PANCREAS OF A 25 CM. COW EMBRYO

Masson's trichromic stain. A group of nerve cells (*n.c.*) partially surrounded by insular cells (*i.c.*) which are still contiguous to an acinus.

that becomes narrower as development proceeds. While this primary island is still very young, forming only a small bud, it comes in contact with a ganglionic anlage, and the two cellular formations become closely packed together inside a common collagenous capsule. In other forms, such as the dog and *Dendrohyrax*, the primary insular cells, sometimes called the cloudy cells of Laguesse, migrate individually out of the wall of the primary tube. The migrating cells are first located in the connective tissue, in which they form rows of variable length; then they penetrate into small nerve trunks, between the fibers of which they continue their migration towards the ganglionic formations. In these ganglia, they become scattered among the ganglionic cells, giving rise to a typical epithelioneural body. When the primary migrating cells show an abundance of cytoplasmic sideraffin granules, it is easy to follow their migration between the nerve fibers and to observe the transformation of these cells that possess a richly granular cytoplasm into cells that show a progressive decrease in the number of granules and that ultimately possess a homogeneous cytoplasm. The facts that support this conception of the transformation of the epi-

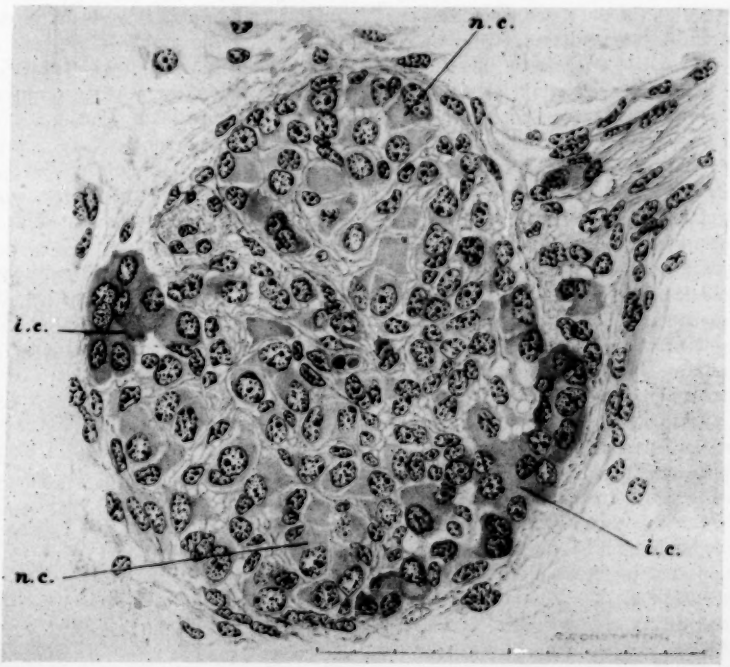


FIG. 2. AN ISOLATED SYMPATHETICO-INSULAR COMPLEX IN THE PANCREAS OF A 25 CM. COW EMBRYO

Same embryo as in Fig. 1. Masson's trichromic stain. An enormous mass of nerve cells (*n.c.*), with small groups of insular cells (*i.c.*) on either side. Note the existence of two insular cells in the nerve leaving the ganglion.

thelial cells are particularly convincing in the dog and in the calf. They strongly support the idea of a neurocrine secretion.

Recently the histogenesis of the pancreas of cow embryos has been studied more completely (Van Campenhout, 1943), from a very full series personally collected so as to give the best possible fixation. This material is by far the best ever observed personally for the demonstration and study of the sympathetico-insular complexes, which I consider the typical instance of epithelioneural association (Figs. 1, 2). It was possible to verify the formation of the complexes and to formulate conclusions which had been insufficiently supported by the material used in the work of 1925 and 1927. Using such customary histological methods as Masson's trichromic staining, as well as various silver impregnation methods, such as Rogers' technique, adapted to this material, it was possible to observe that these insular cells undergo typical cytological transformations, and become identical with authentic ganglionic cells. Between typical insular cells and true ganglionic elements all the intermediate stages can be observed. By accurate drawings of all the cells of certain complexes one can demonstrate the progressive transformation of insular cells into cells like those of the ganglia. It is of course impossible to ascertain whether these modified cells are truly nervous or function as nerve cells; but, speaking in morphological terms, the insular cell has become what is called a nerve cell. After trichromic staining as well as after silver impregnation, it is impossible to establish any line of demarcation between the two cellular types; one passes without a break from insular cells to ganglionic cells.

In the epithelioneural bodies represented by our sympathetico-insular complexes, there is more than an association, and even more than an interpenetration of insular and nervous elements. There is an evident transformation of the first cellular type into the second. This conclusion leads us to adopt Masson's suggestion concerning the transformation of entodermal elements into ganglionic cells. The hypothesis of the existence of a neurentoderm in the human appendix, to be considered later, is strikingly supported by these observations (Van Campenhout, 1943) on the neurentoblast in the pancreas of cow embryos.

In 1937, Simard studied the sympathetico-insular complexes of man. After confirming my descriptions for the embryos, as various authors (Ramez, Lantati, Aron) had already done, he extended to the adult the observations I had made on the adult sheep and those of Glaser on the mouse. It is regrettable, however, that Simard thought it necessary to give a new name, the neuro-insular, to these complexes. This appellation is much less precise than the original; although not actually erroneous, it fails to take into account the important fact that the primary innervation of the pancreas is derived from the orthosympathetic nervous system, as I have shown in the chick (1933) and recently (1945) in the 9 mm. human embryo. The original term "sympathetico-insular complexes" is therefore to be regarded as the most appropriate one, the substitutes proposed, such as neuro-insular and parasympathetico-insular, failing to describe the known facts adequately. The great interest of Simard's work lies in his demonstration that throughout human life sympathetico-insular complexes are found in the pancreas. His beautiful illustrations leave no doubt as to the existence of these bodies.

On the other hand, Simard considers the sympathetico-insular complexes as organs that have a paraganglionic function, on account of their neurocrine secretion performed in close contact with the ganglionic elements. He writes, "Par extension logique, on arriverait à cette idée que tout le système langerhansien, celui des complexes comme celui des ilots simples, aurait la valeur d'un paraganglion neurentodermique." This carries to the extreme the confusion resulting from the arbitrary generalization of the term "paraganglion." The word "paraganglion" has been used for forty years with a definite significance, implying not only the location of the elements in nerve trunks and their possession of a neurocrine function, but further taking their origin into consideration. In order to avoid misunderstanding, the meaning of the word should remain what it was.

The appendicular epithelioneural associations in man

In 1924 Masson described the occurrence in the human vermiform appendix of intimate connections between epithelial cells originating in the appendicular epithelium and the nervous elements. Epithelial cells, usually located at the tips of the glands of Lieberkühn, migrate out of the epithelial layer, pass through the reticular basal membrane, and come in contact with the nervous fibers of the chorion. At the moment of beginning their migration, when budding out of the epithelium, the cells do not show any characteristic feature

which would enable the observer to distinguish them from the neighbouring epithelial cells. But when they reach the nerves, into which they penetrate, they become intensely argentaffin and acquire silver-reducing properties. Migrating between the fibers of the small chorionic nerve trunks, these silver-reducing (method of Masson-Fontana) and argentaffin (method of Rogers) cells progress more or less deeply into the nerve plexus, apparently as far as the first ganglionic masses they meet (see Figs. 3, 4). These ganglionic masses are usually located in the chorion, though sometimes in the submucosa. They then differentiate in two possible ways. (1) A certain number of the cells show secretory characters. They become epithelioid, and arrange themselves in epithelial vesicles surrounding a center of colloid substance. The epithelial vesicles are embedded in a rich nervous plexus. (2) Other cells become spherical or ovoid. Their silver-reducing and argentaffin granules progressively disappear, probably through neurocrine secretion into the nerve trunks in their cytoplasm. Inclusions appear, stainable with methylene blue and considered by the author to be Nissl substance. These cells gradually become more and more like ganglionic cells, while others look more like Schwann cells.

On the basis of these observations, Masson postulated a neurentoderm, signifying that nerve cells can differentiate from cellular elements originating from the entoderm. To be sure, these observations are based on pathological material and are not to be found in every case of appendicular reaction. They characterize a specific type of reaction of the appendicular mucosa, which may be called neurogenous appendicitis, sharply distinguishable from ordinary inflammatory appendicitis. The causal factor, the primum movens, of this reaction is not known, but the facts are significant in spite of the pathological character of the material. Is pathology not natural experimentation?—with the sole difference that in the latter case the observer knows what he has changed in the experimental object, whereas in the former one the observer does not know what Nature has done.

The observations of Masson show conclusively that, in a certain type of appendicitis, entodermal cells migrate out of the epithelium into the nerves of the chorion and the submucosa, that they reach the ganglionic centers of these layers, and that they apparently differentiate into cellular elements similar to nerve cells. The hyperplasia of the nerve plexus of the mucosa that always accompanies this migration and cellular differentiation needs only to be mentioned.

These interesting observations of Masson have been supported by very few workers, among whom Feyrter (1931) and Schack (1932) may be cited. This observer verifies the descriptions of Masson, but he does not admit the transformation of the migrating epithelial cells into cells of nervous appearance.

Van Campenhout (1941a) has studied neurogenous appendicitis and observed facts which seem much more convincing than the illustrations given by Masson in his original and subsequent publications. The budding of epithelial cells through the basal membrane, their migration into the nerves of the chorion and the submucosa, the formation of epithelial vesicles, and the hyperplasia of nervous plexuses all occur exactly as this outstanding pathologist described them. The details I have been fortunate enough to add to his description are of secondary importance. It is well, however, to describe more precisely the cytological transformations of the migrating epithelial cells, an account made possible by the clearcut evidence obtained, thanks to a modified Rogers' silver impregnation after Bouin's fixation.

When the epithelial cells bud on the chorionic surface of the glandular epithelium, they are not argentaffin nor silver-reducing. Only at the very moment of their penetration into the nerves do they become intensely such. These cells are polyhedral in shape. Their nuclei show a few chromatic granules of unequal size. Their cytoplasm is filled with minute silver-reducing or argentaffin granules which sometimes mask the nucleus more or less completely (Figs. 3, 4). Sometimes there are a few clear vacuoles between the granules. As these cells migrate more deeply into the nervous plexus and farther away from the tips of the glands, an evident transformation takes place in a certain number of them. The nucleus becomes slightly more voluminous, and its chromatin shows a tendency to condense into a small number of chromatic nucleoli and ultimately into a single, or sometimes double, chromatic nucleolus. The cytoplasm becomes progressively more abundant, as the silver-reducing and argentaffin granules disappear (see Fig. 4, cell *4*) by excretion into the nerve trunks, through a typical process of neurocrine secretion. At the end of this progressive cytological transformation (fully illustrated in Van Campenhout, 1941a), the migrating epithelial

cells have become entirely similar to typical ganglionic elements. The various histological methods show no difference between authentic ganglionic cells and those like them which silver techniques indicate, by their inclusion of a few silver-stained granules, as of entoblastic origin.

On morphological grounds, the hypothesis of a neurentoderm is based upon well established facts, the accuracy of which cannot be denied and the interpretation of which is evident, namely: Cells like ganglion cells differentiate from cells that migrate out of the appendicular epithelium. The very same conclusion, i.e., the existence of a neurentoblast, has already been drawn from the study of the epithelioneural bodies of the pancreas. In the pathological human appendix of the neurogenous type, there exists a typical association between epithelial cells and nervous elements, and a supplementary neurogenesis does apparently occur. It should be emphasized that silver-reducing and argentaffin properties are only transitory in these epithelial cells. These properties do not exist at the budding stage, and they disappear progressively as the migrating cells become similar to nerve cells. It is therefore incorrect to say that Kulchitzky cells are migrating out of the epithelium, inasmuch as the migration really concerns undifferentiated cells which acquire only temporarily silver-reducing and argentaffin properties similar to those of the intra-epithelial Kulchitzky cells, and lose these properties as they become identical with nerve cells.

FIG. 3. AN EPITHELIONEURAL ASSOCIATION IN THE HUMAN APPENDIX (7326)

Roger's silver impregnation. A rosette of argentaffin cells is located in the midst of numerous nerve fibers.

The neuro-hepatic complexes

Studying in our laboratory the histogenesis of the intrinsic nervous system of the gall bladder of the cow, Grenade (1941) has observed the formation of typical epithelioneural associations. These bodies, which he has called "complexes neuro-hépatiques," arise by budding from the wall of the hepatic ducts as far down as the level of formation of the common bile duct. They can be found, with a frequency that varies considerably with the embryonic stage, along the hepatic ducts, the cystic duct, and at the edges of the transverse sulcus of the liver, at the hepatic root of the lesser omentum. A few form on the hepatic surface of the gall bladder and in the lesser omentum, near the pyloric region. The neuro-hepatic complexes are already to be observed in the 4 cm. embryo; they become more numerous up to the 24 cm. stage, their importance lessening in later stages. They are sometimes enormous, consisting of scores of hepatic cells pressed together with young nerve cells into a single formation; in many instances, the hepatic component is surrounded by nerve fibers that are spread apart by the mass of hepatic cells (Fig. 5).

In these primary neuro-hepatic complexes, the hepatic cells are at first quite normal; but, as development proceeds, they show cytological transformations. The cell itself becomes smaller; its cytoplasm becomes finely granular, the density of the granules being irregular; the nuclear membrane becomes thinner, the nucleoplasm lightly stainable by acid dyes, and the chromatin condensed into a few small spherical granules. This metaplasia of the hepatic cells of the complexes is to be observed in only a few complexes up to the 25 cm. stage; it becomes much more abundant in later stages, from that of 40 cm. up to that of 74 cm., which is the oldest embryo of this series and quite near the end of gestation. The fate of these complexes after birth is still to be determined.

Emphasizing the analogies existing between the neuro-hepatic complexes and the sympathetico-insular complexes of the pancreas, Grenade points

out one important difference between the two series of epithelioneural bodies. In the pancreas, all the primary islands of Laguesse are sympathetico-insular complexes, whereas only a small number of hepatic nodules or cellular bands contribute to the formation of neuro-hepatic complexes. In addition, the metaplasia of the hepatic cells, which characterizes the transformation of primary into secondary complexes, does not represent a transformation of these cells into nerve or neuroid cells. Further studies are of course needed to ascertain the fate of the modified hepatic cells toward the end of gestation and after birth. In regard to this aspect of the question, one might suggest that the masses of epithelial cells described by Goormaghtigh (1936) along the abdominal branches of the vagus and in the liver region of the mouse may well be displaced neuro-hepatic complexes. There are clearly common features in the descriptions of Goormaghtigh and of Grenade, namely, lack of chromaffinity, trabecular aspect, grouping of cells in solid nodules, prismatic shape of the intranervous epithelial cells, close connection of the cells with nerve fibers, and occasional association with ganglionic cells. Since Grenade has been able to observe neuro-hepatic complexes near the pyloric region and in the lesser omentum, their further displacement along the abdominal branches of the vagus might be possible. This also needs further investigation.

The neuro-hepatic complexes of Grenade undoubtedly represent a typical example of epithelioneural bodies. As they have been observed so far only in cow embryos, attempts are now being made to extend these observations to other mammals and to other vertebrates.

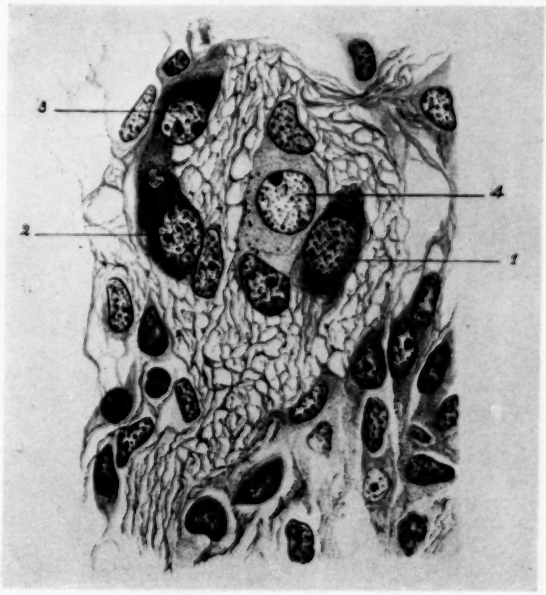


FIG. 4. AN EPITHELIONEURAL ASSOCIATION IN THE HUMAN APPENDIX (7326)

Silver-reducing method of Masson-Fontana, followed by ponceau-aniline blue. In the nerve trunk, besides three Schwann cells, are four silver-reducing cells. Cells *1* and *2* are typical silver-reducing cells. Cell *3* contains a smaller amount of silver-reducing granules, and in its nucleus the chromatin tends to become condensed into a few big nucleoli. Cell *4* has a typical nerve cell nucleus, it is flanked by Schwann cells, and yet it contains a few silver-reducing granules.

The duodenal epithelioneural associations in the cow

An excellent example of neurentoblastic connection has been found in the course of an investigation of the development of the nervous system of the duodenum in cow embryos (Van Campenhout, 1941).

Beginning at a developmental stage of 18 cm.,

the duodenal epithelium shows an active budding of cells on its deep or chorionic surface. This budding process is mainly, but not exclusively, located at or near the apex of the duodenal villi. It is generally multicellular, scores of epithelial cells forming a prominent mass that stands out in the axis of the villus like the clapper of a bell These epithelial buds are intensely argentaffin, and the argentaffinity can be observed from the very beginning of the budding process. The pedicle of the clapper and the epithelial cells to which it is attached are also argentaffin; however, they are not silver-reducing. More or less rapidly these projecting cellular masses arrive in close relationship with the nerve branches running in the axes of the villi. The nerve fibers pass on either side of the epithelial bud, partly surrounding it. It is to be emphasized that the connection with the nerve trunk is not an integral part of the budding process, as many epithelial masses form marked

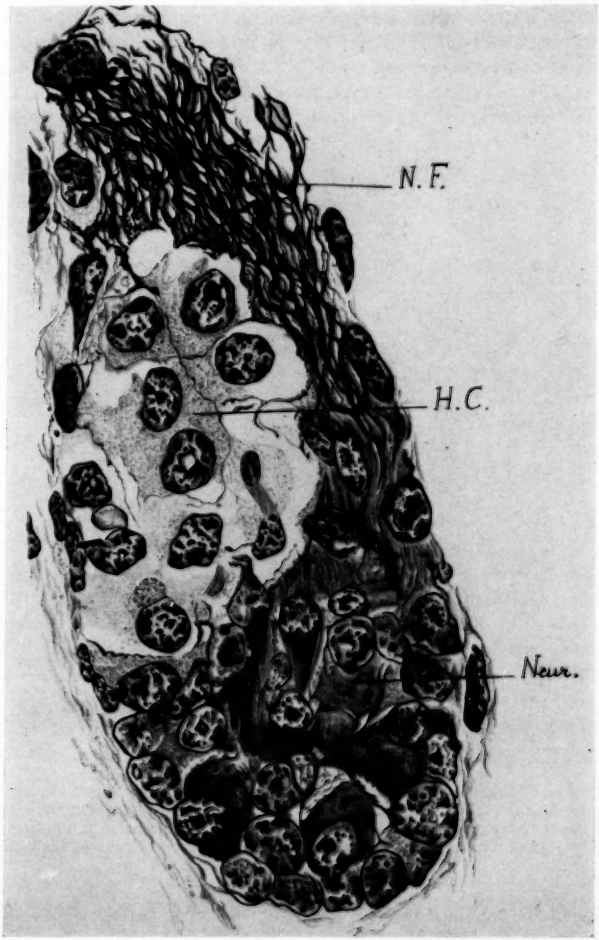


FIG. 5. A TYPICAL NEURO-HEPATIC COMPLEX IN A 19 CM. COW EMBRYO

Roger's silver impregnation. At the bottom, a group of neuroblasts (*Neur.*), from which there arises a nerve trunk (*N.F.*) that passes alongside a group of hepatic cells (*H.C.*). Note the beginning of vacuolization in these hepatic elements.

prominences without showing any trace of relationship with nerves.

When the connection between the epithelial buds and the nerves has been established, the epithelial cells migrate into these nerves, between the nerve fibers, and toward the base or root of the villus (Fig. 6). They reach the chorion and even the submucosa, always remaining intraneural. This migration can be easily followed, thanks to the intense argent-affinity of the migrating epithelial cells. It appears to have reached its goal when the epithelial cells arrive at the first ganglionic nodes, although it is of course impossible to exclude the possibility that a certain number of epithelial cells pass beyond the first ganglionic relay and come to rest in a ganglion located farther away from the epithelium. With the arrival of the epithelial cells in the ganglia, there are at once formed mixed structures in which epithelial argentaffin cells and nervous ganglionic cells are more or less intricately mingled

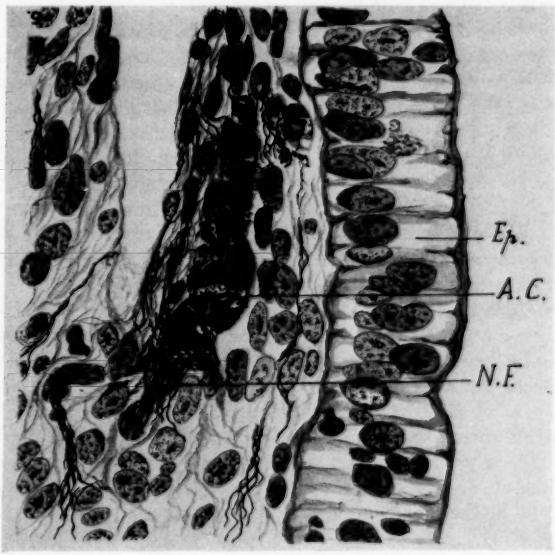


FIG. 6. AN EPITHELIONEURAL ASSOCIATION IN THE DUODENUM OF A 53 CM. COW EMBRYO

Roger's silver impregnation. In the axis of a villus, of which the epithelium is shown on one side (*Ep.*) there is an intricate complex of argentaffin cells (*A.C.*) and of nerve fibers (*N.F.*) twisting around and between the cells.

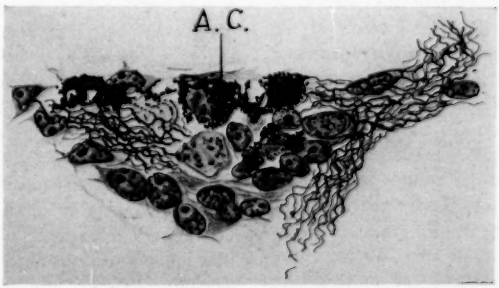


FIG. 7. AN EPITHELIONEURAL ASSOCIATION IN THE DUODENUM OF A 55 CM. COW EMBRYO

Roger's silver impregnation. In a ganglion of the mucosa, a few argentaffin cells (*A.C.*) lie between neuroblasts and nerve fibers. Note the vacuolization of the argentaffin cells.

(Fig. 7). This is a typical epithelioneural body, the epithelial elements of which are derived from the duodenal entoblast.

Already while migrating in the nerve trunks, and most clearly when they have reached their ganglionic relays, the epithelial cells show a typical cytological transformation. Whereas at the budding stage, the cells were argentaffin but not silver-reducing, they now acquire the property of reducing silver. The ability to reduce ammoniated silver solutions seems therefore to be a secondary characteristic, while the affinity for silver nitrate is much more primary. The facts suggest a maturation of the cytoplasmic granules. At first they are immature, argentaffin and non-silver-reducing; later they become mature, argentaffin and silver-reducing. The primary stage appears to be requisite for the secondary; but not all the argentaffin cells necessarily become silver-reducing. To cite a similar example of cell maturation, the cells of Kulchitzky of the intestinal epithelium are argentaffin and silver-reducing, while the cells of Lasowsky of the pancreas are only argentaffin.

The cytological transformation shown by the migrating epithelial cells is much more profound than the mere acquisition of silver-reducing properties. In the cytoplasm of these argentaffin and silver-reducing cells, which is filled with tiny granules, small vacuoles appear. These increase in number until the cytoplasm shows strands of silver-stained granules surrounding nearly contiguous vacuoles, which appear to result from the dissolution of the granules. Ultimately the entire cytoplasm becomes clear. The last trace of the primary argentaffin stage is sometimes represented by a very narrow crown of argentaffin granules located close to the nuclear membrane. This series of stages represents the various steps of a neurocrine secretion process. Sometimes bands of argentaffin granules can be found between the nerve fibers, and sometimes there are no vacuoles in the cytoplasm, the argentaffin granules becoming progressively less avid for silver and progressively fading out. At the end of this cytological transformation, the cells are identical with young neuroblasts located in the ganglia. A few scattered black granules, sometimes to be seen in the cytoplasm, will be the only trace of the previous history of the cells, that is, of their epithelial origin.

The epithelioneural associations found in the duodenum of cow embryos show, firstly, an intricate connection between epithelial cells and young nerve cells. Secondly, they are a good illustration of a neurocrine secretion. In the third place, the argentaffin cells become so indistinguishable from authentic young nerve cells that, looking at a submucous ganglion, one cannot be sure whether it is a pure, authentic ganglion or whether it arose from an epithelioneural association. The last observation is in complete agreement with those made by the author on the pancreas and with those made by Masson and by the author on the appendix.

The difficulties met in collecting series of mammalian embryos have made it impossible to extend these observations to other forms. It is perhaps worth mentioning that, in the duodenum of a 25 cm. human embryo, we have observed typical buddings of the epithelium at the apices of villi, buddings which are argentaffin, and project more or less markedly into the axis of the villus. This observation on a single embryo obviously suggests that, in human embryos, conditions are like those described in the cow embryos.

The epithelioneural associations of the ganglia of the mixed cranial nerves in the pig

In 1938, de Winiwarter described the contribution of the branchial hypoblast to the composition of the ganglia of the mixed cranial nerves in the pig. At the 10–15 mm. stage, long rows of cells detach themselves from the branchial hypoblast. A certain number become dispersed in the mesenchyme, while others penetrate the ganglionic anlagen of the glossopharyngeal and pneumogastric nerves. The fate of these hypoblastic cells in the ganglia has not been followed, but the fact that these ganglia have a hypoblastic component is established. This represents a new neurentoblastic association.

If the migrating hypoblastic elements become nerve cells, the ganglia of the last two mixed cranial nerves will come to contain four types of nerve cells of the following origins: ganglionic crest, dorsolateral and epibranchial placodes, and hypoblastic placode. The author has already suggested a relationship between this quadruple origin and the functional constitution of these mixed cranial nerves, the ganglionic crest contributing the elements concerned with the general somatic afferent system; the dorsolateral placodes giving rise to the elements of the special somatic afferent system; the epibranchial placodes originating the elements responsible for the special visceral sensory system; and the hypoblast furnishing the ganglionic cells related to the general visceral sensory system.

While such a system of relationships is not yet fully demonstrated, it corresponds very well with the known facts. Without considering here all the arguments in favor of this view, mention may be made of (1), the importance of the hypoblastic contribution to the pneumogastric nerve, which possesses the largest visceral general sensory component; and on the other hand, the absence of such a contribution to the trigeminal nerve, which has no visceral component; and (2), the importance of the hypoblastic contribution in mammals, which possess a well developed visceral sensory system, and its apparent absence in amphibians, which have a poorly developed general visceral sensory system.

This viewpoint further leads us to consider the neurentoblastic associations that show a cytological transformation of elements into cells similar to ganglion cells, as so many instances of entoblastic placodes furnishing cells to the autonomic nervous system—more precisely, to its afferent portion. In other words, the general afferent visceral system is regarded as represented by nerve cells derived from the branchial hypoblast in very young embryonic stages, originating in the duodenum and in the pancreas, and receiving a possible contribution from the vermiform appendix. Further investigation will be necessary to substantiate this hypothesis.

It is of course possible that the hypoblastic elements migrating into the ganglia of the glossopharyngeal and pneumogastric nerves do not become ganglion cells. They might give rise to sheath cells, or become intraneural epithelial masses, such as the intravagal epithelial formations described by de Winiwarter, Nonidez, and Goormaghtigh. If so, these masses, which have been called "vagal paraganglia," would be entoblastic in origin and would represent neurentoblastic associations.

III. THE NEURO-MESOBLASTIC COMPLEXES

In 1923, Berger called attention to the existence, in the hilus of the gonads, of epithelial bands or masses characterized by their very intimate relationship with the nerves. These epithelial cells are located in the region of the rete testis, in the albuginea of the testis, and along the spermatic cord, and represent an extension of the intratesticular interstitial gland, through neurotropism, outside the testis. In the female, they are found also in the hilus of the ovary and in the broad ligament. These epithelial cells were called "cellules sympathicotropes," on account of their location in, along, or against the sympathetic nerves. They represent an intimate association between epithelial cells of mesodermal origin and nerve fibers.

The real nature and significance of Berger's sympathicotrope cells have been widely discussed. Numerous workers (de Winiwarter, Wallert, 1927; Celestino da Costa; Neumann, 1927) consider them chromaffin cells, and paraganglionic, the crystalloid inclusion not being regarded as a true crystalloid of Reinke. Other investigators (Kohn, 1928; Brannan, 1927; Wieser, 1931) hold that the sympathicotrope cells are identical with the interstitial cells of Leydig, in testis as in ovary. In a series of papers, Berger (1928, 1932, 1935) presented new arguments for his view. He made a detailed comparative study of the sympathicotrope cells and of the chromaffin elements, and showed that the supposedly positive chrom-reaction is, in a certain number of cases at least, the result of a pigmentary veil which is brownish in aspect even after non-chromic fixations. He was able to observe the coexistence of sympathicotrope and chromaffin cells, thereby emphasizing the differences between these two types of cells. Yet all this evidence has unfortunately failed to convince those who, from the beginning, disagreed with Berger's views.

In this impasse, what was most needed was a study of the gonads, particularly the testis, by an impartial observer. Having personally made a careful study of pathological and surgical material, I find the answer clear and unequivocal. Berger's descriptions correspond exactly to the observed facts, and his interpretation appears to be quite correct (Van Campenhout, 1945).

In normal and cryptorchid testes, there are many masses of epithelial cells embedded in nerve trunks in the albuginea (Fig. 8). These epithelial cells may be scattered between the nerve fibers, or they may be grouped in cellular bands or small masses. The cytoplasm of the epithelial cells sometimes contains a typical crystalloid inclusion of Reinke (Fig. 8, *B*) considered by all histologists to exist only in the cells of Leydig, and of course not to be mistaken for the crystalloids of Lubarsch and Spangaro that are found in the cells of Sertoli and even in the spermatogonial elements. The use of silver impregnation methods on the nerve fibers of these epithelioneural associations shows, furthermore, that the sympathicotrope cells are not argentaffin. It follows that these cells are not chromaffin either, since all chromaffin elements are known to be argentaffin.

In the cryptorchid testis, interstitial cells are to be seen located in the nerves. Such cells are generally few in number in any one section, as they are scattered along the extent of the nerve fibers. They are typical interstitial elements. The observation of these intratesticular interstitial cells located in the nerves, between the nerve fibers, is corroborated by the existence of other interstitial cells lying close against the nerve sheath. Our observations leave no doubt that intratesticular interstitial cells are able to penetrate the intratesticular nerves. The cytological identity of the extraneural and intraneural interstitial cells is evident.

I. *Neuro-ectodermal organs:* The paraganglia, including the medullary zone of the adrenals. In these organs, the epithelial component originates from the ganglionic (neural) crest.

II. *Neuro-entoblastic organs:* The sympathetico-insular complexes of the pancreas, the neuro-hepatic complexes, the appendicular and the duodenal epithelioneural associations. In these organs, the epithelial component originates from the embryonic entoblast or the adult entoderm. In three of these associations, evidence of the transformation of epithelial cells into nerve cells can be found, supporting the theory of the neurentoderm (Masson).

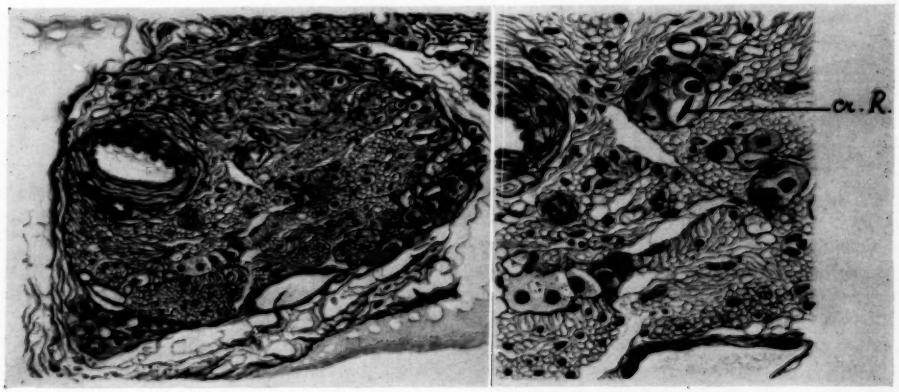


FIG. 8. AN EPITHELIONEURAL ASSOCIATION IN THE HUMAN TESTIS (35 YEAR-OLD)

A, Low power magnification. A nerve trunk in the albuginea; in the nerve, epithelial elements. *B*, higher magnification of the central area of the same. In one cell a typical crystalloid inclusion of Reinke (*cr. R.*).

The sympathicotrope cells described by Berger are true Leydig cells, possessing all the typical characteristics of such cells, being non-argentaffin, and to be seen penetrating into the intratesticular nerves. They represent the mesoblastic component of a typical epithelioneural association. To the possible objection that just the converse is true and that the sympathicotrope cells and the interstitial cells are migrating along the nerves towards the testis, answer is given by the histogenetic studies of many authors (de Winiwarter and Sainmont, 1909; and others) which show the local origin of the interstitial cells.

SUMMARY

The various formations considered in this brief review of the epithelioneural bodies can be summarized as follows:

In the same group is to be listed the contribution of the branchial entoblast to the ganglia of mixed cranial nerves, observed by de Winiwarter.

III. *Neuro-mesoblastic organs:* The sympathicotrope cells of Berger. The epithelial component is here represented by the mesoblastic cells of Leydig.

IV. *Neuro-epithelial associations of doubtful origin:* The glomus caroticum, the glomus coccygeum, the various epithelial masses hypothetically called "vagal" and "mixed" paraganglia. This group of epithelioneural bodies in particular should now be subjected to combined histo-embryogenetic researches. The results of work now in progress should enable us to place the organs of this doubtful assemblage in one or another of the three definite categories of epithelioneural association.

LIST OF LITERATURE

ARNOLD, J. 1867. Über die Glomeruli caudales der Saugetiere. *Virchows Arch.* 39: 497–512.

ARON, M. 1931. Recherches histophysiologiques sur le fonctionnement et les corrélations des glandes endocrines embryonnaires chez les Vertébrés. *Bull. Biol. France Belg.*, 65: 437–521.

BENOIT, A. 1928. Recherches sur l'origine et la signification du ganglion carotidien. *Arch. Biol.*, 38: 220–247.

BERGER, L. 1923. La glande sympathicotrope du hile de l'ovaire; ses homologies avec la glande interstitielle du testicule; les rapports nerveux des deux glandes. *Arch. Anat. Histol. Embryol.*, 2: 255–306.

——. 1928. Sympathicotrope Zellen im Eierstock und ihre neurokrine Funktion. *Virchows Arch.*, 267: 433–445.

——. 1932. Cellules sympathicotropes, cellules phéochromes et cellules interstitielles. *Bull. Histol. appl.*, 9: 5–21.

——. 1935. Coexistence de cellules sympathicotropes et de cellules phéochromes dans un testicule de nouveau-né. *Arch. Anat. micr.*, 31: 101–109.

BLOTEVOGEL, W. 1926. Zu den zyklischen Veränderungen im Ganglion cervicale uteri der Maus. *Anat. Anz.*, 60, ErgHft.: 233.

——. 1927. Sympathikus und Sexualzyklus. *Z. mikr. anat. Forsch.*, 10: 141.

BOTAR, J., et L. PRIBEC. 1935. Corpuscule paraganglionnaire dans l'orbite. *Ann. Anat. Path.*, 12: 227–228.

BRANNAN, D. 1927. The sympathicotrop cells of the ovary and testis. *Amer. J. Path.* 3: 343–353.

CANNON, W. B., and A. ROSENBLUTH. 1937. The transmission of impulses through a sympathetic ganglion. *Amer. J. Physiol.*, 119: 221–235.

CELESTINO DA COSTA, A. 1917. Origine et développement de l'appareil surrénal et du système nerveux sympathique chez les Cheiroptères. *Mém. Soc. port. Sc. nat., Sér. biol.*, 4: 1–103.

——. 1935. Sur le développement comparé du système paraganglionnaire chez les Mammifères. *C. R. Cong. int. Zool., Lisbonne*, 574–589.

——. 1939. Le système paraganglionnaire. La notion de paraganglion et les principaux problèmes qu'elle soulève. *Montpellier Méd.*, 16: 139–167.

CHANG, H. C., and J. H. GADDUM. 1933. Choline esters in tissue extracts. *J. Physiol.*, 79: 255–285.

CHRISTIE, R. V. 1933. The function of the carotid gland. *Endocrinology*, 17: 421–432; 433–444.

COLLIN, R. 1928. La neurocrinie hypophysaire. Etude histophysiologique du complexe tubéro-infundibulo-pituitaire. *Arch. Morphol. gén. expér.*, 28: 1–102.

DE CASTRO, F. 1928. Sur la structure et l'innervation du sinus carotidien de l'homme et des Mammifères. Nouveaux faits sur l'innervation et la fonction du glomus caroticum. *Trav. Lab. Rech. biol. Madrid*, 25: 331–380.

DOGIEL, A. S. 1894. Die Nervenendigungen in den Nebennieren der Saugetiere. *Arch. Anat. EntwGsch.*, 1894: 90–104.

FEYRTER, O. 1931. Zur Frage der Karzinoide. *Verh. dtsch. path. Gesellsch.*, 29: 286–289.

FUSARI, R. 1891. De la terminaison des fibres nerveuses dans les capsules surrénales des Mammifères. *Arch. ital. Biol.*, 16: 262–275.

GASKELL, J. T. 1916. *The involuntary nervous system.* Longmans, Green and Co., London.

GERARD, P., R. CORDIER, et L. LISON. 1930. Sur la nature de la réaction chromaffine. *C. R. Soc. Biol. Paris*, 105: 876–877.

GLASER, M. 1926. Über die Veränderungen im Pankreas der weissen Maus nach Throxininjektionen. *Arch. EntwMech. Org.*, 107: 98–128.

GOORMAGHTIGH, N. 1921. Organogénèse et Histogénèse de la capsule surrénale et du plexus coeliaque. *Arch. Biol.*, 31: 83–172.

——. 1936. On the existence of abdominal vagal paraganglia in the adult mouse. *J. Anat.*, 71: 77–90.

——, et R. PANNIER. 1939. Les paraganglions du coeur et des zones vaso-sensibles carotidienne et cardio-aortique chez le chat adulte. *Arch. Biol.*, 50: 455–533.

GOSSES, J. 1936. *Het Glomus caroticum.* Dissert., Amsterdam.

GRENADE, A. 1941. Le développement du système nerveux de la vésicule biliaire. Les complexes neuro-hépatiques. *Arch. Biol.*, 52: 419–472.

GUILD, S. R. 1941. A hitherto unrecognized structure, the Glomus Jugularis, in man. *Anat. Rec.*, 79 (suppl. 2): 28.

HAMMAR, J. A. 1934. Zur Histogenese der Paraganglien beim Menschen. *Z. mikr. anat. Forsch.*, 36: 10–22.

HEYMANS, C., J. J. BOUCKAERT, et R. PANNIER. 1944. Sur la localisation des éléments chimio- et pressosensibles de la zone rétroréflexogène sino-carotidienne. *Bull. Acad. roy. méd. Belg.*, 9 (in press).

HOLLINSHEAD, W. H. 1941. A histological comparison of the carotid and coccygeal bodies. *Anat. Rec.*, 79 (suppl. 2): 73.

KOHN, A. 1902. Das chromaffine Gewebe. *Ergebn. Anat. EntwGsch.*, 12: 253–348.

——. 1903. Die Paraganglien. *Arch. mikr. Anat.*, 62: 263–366.

——. 1928. Über "Leydigsche Zwischenzellen" im Hilus des menschlichen Eierstockes. *Endokrinologie*, 1: 3–10.

KOLOSSOW, N. C. 1930. Zur Frage der Innervation der Nebennieren. *Z. mikr. anat. Forsch.*, 20: 107–121.

LASOWSKY, J. M. 1931. Zur Morphologie der sogenannten argentaffinen Zellen der Pankreasdrüse. *Frankfurt. Z. Path.*, 41: 1–13.

LENTATI, G. 1930. Ricerche sulla istogenesi delle isole del Langerhans in alcuni Mammiferi. *Arch. ital. Anat. Embryol.*, 28: 133–161.

LISON, R. 1936. *Histochimie animale.* Gauthier-Villars, Paris.

MASSON, P. 1924. Appendicite neurogène et Carcinoides. *Ann. Anat. Path.*, 1: 3–59.

——. 1932. Neural proliferations in the vermiform appendix. In *Cytology and Cellular Pathology of the Nervous System*, by Pennfield. Hoeber, New York.

——. 1937. Les Glomus neuro-vasculaires. *Actual. sci. industr.* Hermann, Paris.

MEIJLING, H. A. 1938. Bau und Innervation vom Glomus caroticum und Sinus caroticus. *Acta neerland. Morphol.*, 1: 193–288.

MULON, P. 1904. Spécificité de la réaction chromaffine: glandes adrénalinogènes. *C. R. Soc. Biol., Paris*, 56: 113–115.

MURATORI, G. 1932. Contributo all'innervazione del tissuto paraganglionare annesso al sistema del vago (glomo-carotico, paragangli extravagali et intravagali). *Anat. Anz.*, 75: 115–123.

NEUMANN, H. O. 1927. Fremdartige Zellen in Eierstock. *Virchows Arch.*, 263: 274–278.

NONIDEZ, J. F. 1935. The aortic (depressor) nerve and its associated epithelioid body, the glomus aorticum. *Amer. J. Anat.*, 57: 259–293.

——. 1936. Observations on the blood supply and the innervation of the aortic paraganglia of the cat. *J. Anat.*, 70: 215–224.

PALME, F. 1934. Die Paraganglien über dem Herzen und im Endigungsgebiet des Nervus depressor. *Z. mikr. anat. Forsch.*, 36: 391–420.

PENITSCHKA, W. 1931. Paraganglion aorticum Supracardiale. *Z. mikr. anat. Forsch.*, 24: 24–37.

PINES, L. 1924. Über die Innervation des chromaffinen Gewebes des Sympathikus und über das sympathico-chromaffine System im allgemeinen. *Arch. Psych. Nervenkrank.*, 70: 636–647.

POLL, H. 1906. Die vergleichende Entwickelungsgeschichte der Nebennierensysteme der Wirbeltiere. In *Handbuch des vergleichenden und experimentellen Entwickelungslehre der Wirbeltiere*, O. Hertwig, ed., 3: 443–602. G. Fischer, Jena.

RAMEZ, E. 1926. *Contribution à l'étude histogénique du pancréas chez le foetus humain.* Thèse, Lille.

RIEGELE, L. 1928. Die Nerven des Glomus caroticum beim Menschen mit kurzer Übersicht über den histologischen Aufbau des Organs. *Z. Anat. EntwGsch.*, 86: 142–167.

SCHACK, L. 1932. Über die gelben Zellen im menschlichen Wurmfortsatz. *Beitr. path. Anat.*, 90: 441-478.

SCHUMACHER, S. VON. 1908. Über das Glomus coccygeum des Menschen und die Glomeruli caudales der Saugetiere. *Arch. mikr. Anat.*, 71: 58–115.

——. 1938. Über die Bedeutung der arterio-venösen Anastomosen und der epithelioiden Muskelzellen. *Z. mikr. anat. Forsch.*, 43: 107–130.

SETO, H. 1935. Über zwischen Aorta und Arteria pulmonalis gelegenen Herzparaganglien. *Z. Zellforsch.*, 22: 213–231.

SIMARD, L. C. 1937. Les complexes neuro-insulaires du pancréas humain. *Arch. Anat. micr.*, 33: 49–64.

——, and E. VAN CAMPENHOUT. 1932. The embryonic development of argentaffin cells in the chick intestine. *Anat. Rec.*, 53: 141–151.

SMIRNOW, A. 1890. Die Struktur der Nervenzellen im Sympathikus der Amphibien. *Arch. mikr. Anat.*, 35: 407–424.

STOERK, O., und H. HABERER. 1908. Beitrag zur Morphologie des Nebennierenmarkes. *Arch. mikr. Anat.*, 72: 481–496.

STOHR, PH. 1935. Zur Innervation der menschlichen Nebenniere. *Z. Anat. EntwGsch.*, 104: 475–490.

SZEPSENWOHL, J. 1935. Sur l'origine du glomus caroticum chez les embryons d'Oiseau (canard). *C. R. Ass. Anat. Montpellier*, 30: 469–477.

VAN CAMPENHOUT, E. 1925. Etude sur le développement et la signification morphologique des ilots endocrines du pancréas chez l'embryon de mouton. *Arch. Biol.*, 35: 45–88.

——. 1927. Contribution à l'histogénèse du pancréas chez quelques Mammifères. *Arch. Biol.*, 37: 121–171.

——. 1930a. Historical Survey of the development of the sympathetic nervous system. *Quart. Rev. Biol.*, 5: 23–50; 217–234.

——. 1930b. Contribution to the problem of the development of the sympathetic nervous system. *J. exp. Zool.*, 56: 295–320.

——. 1933. The innervation of the digestive tract of the 6-day chick embryo. *Anat. Rec.*, 56: 111–118.

——. 1941a. Le neurentoderme appendiculaire. *Bull. Acad. roy. méd. Belg.*, 6: 406–424.

——. 1941b. Participation de l'épithélium à la constitution des plexus nerveux intrinsèques du duodenum de l'embryon de vache. *Arch. Biol.*, 52: 473–508.

——. 1943a. Le neurentoblaste pancréatique chez l'embryon de vache. *Bull. Acad. roy. méd. Belg.*, 8: 254–264.

——. 1943b. Au sujet du développement des placodes épiblastiques des nerfs craniens chez le poulet. *Arch. Biol.*, 54: 93–110.

——. 1945. Le système nerveux viscéral de l'embryon humain de 9 mm. *Bull. Acad. roy. méd. Belg.*, 10 (in press).

——, et C. DE MUYLDER. 1945. Au sujet des cellules sympathicotropes du testicule. *C. R. Soc. Biol. Paris*, in press.

WALLART, C. 1927. Sur le tissu paraganglionnaire de l'ovaire humain. *Arch. Anat. Histol. Embryol.*, 7: 1–39.

WATZKA, M. 1931. Ueber die Verbindungen inkretorischer und neurogener Organe. *Anat. Anz.*, 71: 185–190.

——. 1937. Über die Entwicklung des Paraganglion caroticum der Säugetiere. *Z. Anat. EntwGsch.*, 108: 61–73.

WIESER, N. 1931. Über die Hiluszellen der Keimdrüsen, insbesondere im Vergleich mit den Leydigschen Zwischenzellen. *Endokrinologie*, 8: 321–404.

WINIWARTER, H. DE. 1924. L'appareil phéochrome de l'ovaire humain. *Bull. Histol. appl.*, 1: 1–19.

——. 1934. Origine et signification du ganglion carotidien. *C. R. Ass. Anat. Bruxelles*, 29: 519–528.

——. 1938. Origine et développement du ganglion carotidien. *Arch. Biol.*, 50: 67–94.

——, et H. SAINMONT. 1909. Nouvelles recherches sur l'ovogénèse et l'organogénèse de l'ovaire des Mammifères (chat). *Arch. Biol.*, 24: 1–142.

ZUCKERKANDL, E. 1912. Die Entwickelung der chromaffinen Organen und der Nebenniere. In *Textbook of Human Embryology*, Vol. 2, by Keibel and Mall. Lippincott, Philadelphia.

THE ROLES OF MOTILE LARVAE AND FIXED ADULTS IN THE ORIGIN OF THE VERTEBRATES

By WILLIAM K. GREGORY

American Museum of Natural History

FROM GEOFFROY SAINT-HILAIRE TO BATESON AND MORGAN

BEFORE the rise of genetics and other branches of experimental biology, such major problems as the origin of the vertebrates and the interrelationships of the various invertebrate phyla were actively investigated, and a number of possible solutions were put forth, but no consensus was reached. Geoffroy Saint-Hilaire (1818) saw in the insect merely a much modified vertebrate turned over on its back. To Dohrn (1875), Semper (1875–1876), Minot (1897), and others a vertebrate was essentially an annelid worm with an overgrown brain and appropriate accessories. To Patten (1884–1912) it was clear that vertebrates were derived from the arachnid trunk and that their nearest living relatives were the king crabs (*Limulus*) and the scorpions. Gaskell (1896–1908), starting from the same forms as did Patten, advanced to the brain and other systems of the larval lamprey by paths Patten deemed impossible, and found his views bitterly contested by his contemporaries and ignored by almost all later students. Hubrecht (1887) favored the nemertean worms as potential vertebrates and derived the notochord from their proboscis. Masterman (1898), profiting by embryological studies on the sources of the coelome in various phyla, pushed the origin of the vertebrates back to the coelenterate stage and showed how easily a diagram of a jellyfish could be changed into a diagram of the early embryo of *Amphioxus*.

Even Bateson (1884, 1885), in his younger, more liberal days at least, contributed through his studies on the embryology of the acorn worms (*Balanoglossus*) to the contemporary wide interest in the problem of the origin of the vertebrates. But after he had experienced the satisfactions of experimental science, Bateson (1914) formed a poor opinion of those who indulged in what he regarded as idle speculations and held them up to ridicule, comparing their attempts to explain "adaptations" with the optimistic vaporings of Voltaire's Dr. Pangloss.

Bateson's American colleague T. H. Morgan, although he had also contributed to the knowledge of the development of *Balanoglossus* (Morgan, 1891, 1894) likewise encouraged a sceptical attitude toward supposedly outworn theories of the origin of the vertebrates and toward all a priori reasoning without benefit of experimental science (Morgan, 1932). Indeed, one of his students at Columbia University even disapproved of the terms homology, analogy, and adaptation as largely subjective and experimentally unverifiable. E. B. Wilson, whose graduate course on the invertebrates dealt at some length with the embryological and cytological evidence bearing on the interrelationships of the various invertebrate and vertebrate phyla, was persuaded to withdraw this superb course in favor of allegedly more factual courses in cytology and genetics. In that period of brilliant and far-reaching successes in the genetic and experimental fields and in the application of statistical methods and mathematical analysis to the problems of growth and form, it was inevitable that the problem of the origin of the vertebrates, dealing with a very distant event by means of qualitative analysis of morphological patterns, should come to be regarded in many quarters as of less than academic importance.

But neither at Columbia University nor at the allied American Museum of Natural History were any attempts made to muzzle the dissenting minority, and the present writer continued to conduct a yearly review of the problem of the origin of the vertebrates, gradually arriving at the conclusions recorded in this paper and more fully in his forthcoming book, *Evolution Emerging* (1948). Nor was it by accident that it was at Oxford, where scholars of classical, mediaeval, and modern learning were not easily stampeded from the established ways, that E. S. Goodrich (1909) published his great work on *Cyclostomes and Fishes*. This book opens with a discussion of cephalization, that is, of the integration of neuro-muscular segments into a head, a process which lies at the crux of the problem of the origin of the vertebrates. For one of the first questions to arise is: Was the complex head of the vertebrates derived from the considerably less complex head of the arthropods?

or was it evolved altogether independently and from a quite different phylogenetic source?

FROM SEMPER TO PATTEN AND GASKELL

The essential idea of Etienne Geoffroy Saint-Hilaire, namely, that in an insect (Fig. 1) the functionally ventral or neural surface is equivalent in the vertebrate to the dorsal surface with its nerve cord, was more effectively developed by Dohrn, Semper, and their successors, Beard (1886, 1888), Minot (1897), and others, who chose the annelid worms as the starting-point. Delage and Hérouard (1898), in their excellent review of the possible relationships of each of the classes of pro-

In the annelids, in common with the other jointed invertebrates, the oesophagus is surrounded by a complete nerve ring or nerve collar, connecting the cerebral ganglia above with the paired ventral nerve cord below. Essentially the same conditions occur in the crustaceans, arachnids, and insects. According to Patten and others before him, the passageway that led from the roof of the embryonic vertebrate mouth (Fig. 2, A) upward and backward through the aqueduct of Sylvius to the fourth ventricle of the brain, represents the old oesophagus of the jointed animals. Some authors imagined that before the cerebellum became enlarged this tube ended at the old mouth, repre-

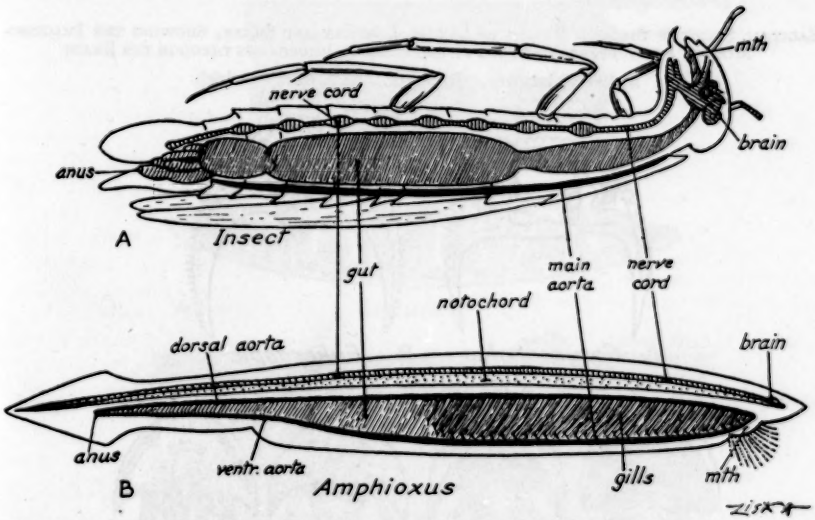


FIG. 1. RELATIONS OF NERVE CORD AND OTHER LANDMARKS CONTRASTED IN INSECT (INVERTED) AND CHORDATE
Data from Parker and Haswell, Delage and Hérouard

chordates, noted that Minot regarded *Amphioxus* as establishing a quite near relationship between the vertebrates and the annelids because it shares with the latter such important characters as the total segmentation of the mesoderm, the metamerism of the genital organs, and especially of the tubules of Bovari—excretory organs that recall the nephridia of annelids. But Delage and Hérouard (pp. 337 ff.) also concluded that these resemblances are far outweighed by the profound differences between annelids and vertebrates, namely, by the presence in the latter of a dorsal, rather than ventral, nerve cord and by the entire construction of the vertebrate nervous system and gill-bearing pharynx.

sented by the fossa rhomboidea of the medulla; and thus the two halves of the medulla were equated with the lateral parts of the circumoesophageal ring of arthropods.

Patten (1912, pp. 466–467) and others held that the "old mouth" of the jointed animals was gradually closed up by the overgrowth of the brain and that a new mouth was opened on the opposite or haemal surface. Patten's many diagrams ingeniously picture this assumed connecting passage between the gut and the brain, together with the gradual closing of the "old mouth" and the opening of the new one, the stomodaeum (Fig. 2, A, B; Fig. 3). But in the very assumption that these ideas are facts, he begged the question for his sol-

ution of the problem of the origin of the vertebrates.

opening into the floor of the brain was a secondary result, analogous with a fistula between two adja-

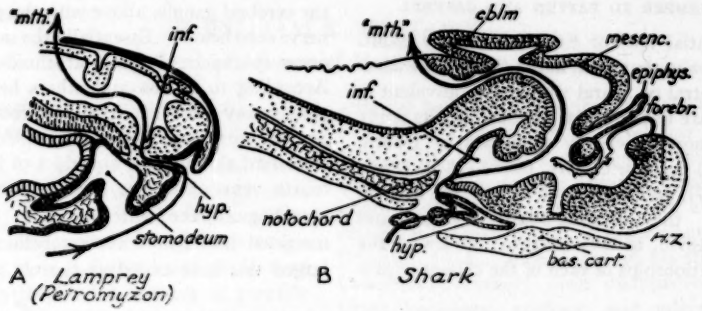


FIG. 2. SAGITTAL SECTIONS THROUGH BRAINS OF LARVAL LAMPREY AND SHARK, SHOWING THE IMAGINED "OLD MOUTH" AND SUPPOSED PATHWAY OF THE FORMER OESOPHAGUS THROUGH THE BRAIN

A, Larval lamprey. B, Shark. Data from Goodrich

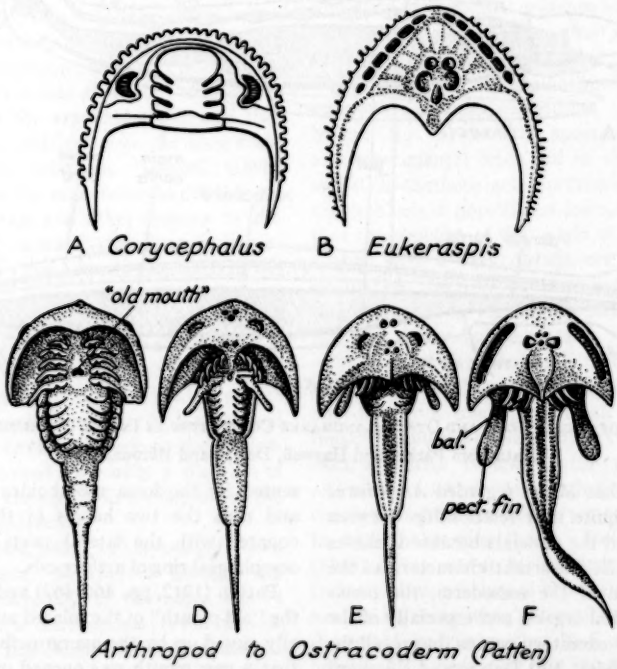


FIG. 3. PATTEN'S COMPARISON OF TRILOBITE AND OSTRACODERM

A, Trilobite. B, Ostracoderm. C-F, The hypothetical shifting of the shield from the haemal to the neural surface. After Patten

A less strained inference would be that the hypophysial outpocketing from the pharynx had something to do with the beginning of the development of the pituitary gland, and that perhaps the cent pockets, such as the inner branchial pouch and the outer gill cleft of fish embryos.

The arthropods have cranial sense organs, cranial nerves, and brains, all more or less similar in func-

tion to those of vertebrates. But just as there is good reason to infer that the eyes of cephalopods are merely analogous with and not truly homologous with those of vertebrates, so it seems that Patten, in equating the eyes of the arthropods and vertebrates, has again begged the question. Even the resemblance between *Limulus* and the Silurian-Devonian ostracoderm pteraspids in the sections of the exoskeleton (Fig. 4) seems at least no closer than the resemblance between the eyes of cephalopods and those of vertebrates. In this case the necessity for strengthening the cephalothoracic shield is met in both forms by the development of a tough, unyielding, outer or carapacial layer of the epithelium, supported by a middle trabecular layer and a strong inner layer (Fig. 4); but these superficial resemblances are accompanied by marked differences. The inner or basal layer in *Limulus* is cancellous and irregular; in the ostracoderm it is regularly stratified, forming an isopedine layer. The outer layer in *Limulus* lacks the individual dental tubercles or denticles which in the more primitive ostracoderm give rise to the layer known as cosmine.

In the annelid *Nereis* and in *Amphioxus* the coelome and the mesoderm are formed in widely different ways: in the former (Fig. 5, A) from a certain single daughter cell of the micromere series; in the latter, from enterocoelic pouches or their predecessors, the cells of the mesoderm crescent around the blastopore (Conklin, 1932). This and other cytological differences led embryologists to refer the annelids, arthropods, and other jointed animals to a great "teloblastic" superphylum; the chordates, to the "enteroblastic" superphylum.

Such profound differences between the arthropods and the chordates in development led both Bateson and Masterman to conclude that:

"If the metameric or secondary segmentation took place between the stages of Balanoglossus and Amphioxus it is evident that, as Bateson has emphasised, the 'segmented' Invertebrata and the segmented Vertebrata must be genetically distinct in spite of the most elaborate anatomical resemblances. The recognition of this archimeric segmentation and its relationships to the secondary or 'metameric' segmentation will, I venture to think, not only clear up many difficulties in tracing the

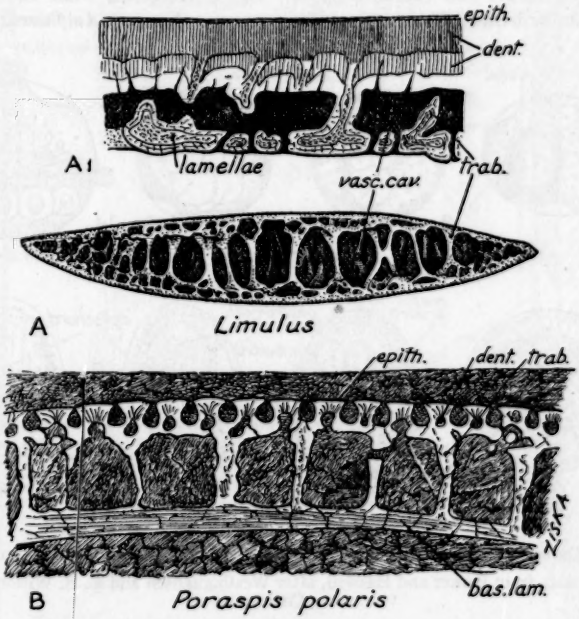


FIG. 4. MICROSECTIONS OF THE CARAPACE OF LIMULUS AND PTERASPID
A, A1, Limulus, after Patten. B, Pteraspid, after Kiaer

origin of Vertebrata, but will furnish a sound basis, for the phyletic classification of the Coelomata." (Masterman, 1898, p. 330.)

Professor E. B. Wilson, in his graduate course in comparative embryology, set forth the evidence for the validity of this classification. Professor J. H. McGregor, Professor H. E. Crampton, and other authorities in this field, inform me that these distinctions between the jointed animals and the chordates still hold good. Allee (1927, pp. 263, 269, 291, 293), in his excellent review of the invertebrates, builds his diagram of the phyletic relations of the various invertebrate and chordate phyla upon the same or similar bases. The consequences of the acceptance of this classification are very damaging to Patten's theory.

In both arthropods and chordates the complex head has been built up by the combination and integration of neuro-muscular segments. Patten (1912, p. 471) accordingly bracketed the arthropods and the vertebrates together in a superphylum, the Syncephalata; but since *Balanoglossus*, the tunicates, and *Amphioxus* have little or no head, he brigaded them (*ibid.*, pp. 397, 471) as the Acraniata and derived them independently of the vertebrates as divergent offshoots of primitive Nauplius-like crustaceans (*ibid.*, pp. 466, 467) His diagram also implies a close phylogenetic relationship between the vertebrates and the arachnids, but a very distant relationship between the vertebrates and *Amphioxus*. According to this view, the resemblance of *Amphioxus* to the vertebrates is largely due to parallelism. But since the previously mentioned division of triploblastic animals into teloblastic (e.g., jointed animals) and enteroblastic (chiefly chordates and echinoderms), on the basis of their different ways of forming the mesoderm and the coelome, has been and is still accepted by high authorities, it now seems evident that such resemblances as there are between arthropods and vertebrates are examples of parallelism and convergence, while the major characters in common between *Amphioxus* and the vertebrates are truly homologous. In the light also of other evidence, it now seems highly probable that a complex head was evolved independently in both arthropods and vertebrates during their transformation from virtually headless, slow-moving feeders on small food to such actively predatory forms as the scorpions on the one hand and the typical vertebrates on the other.

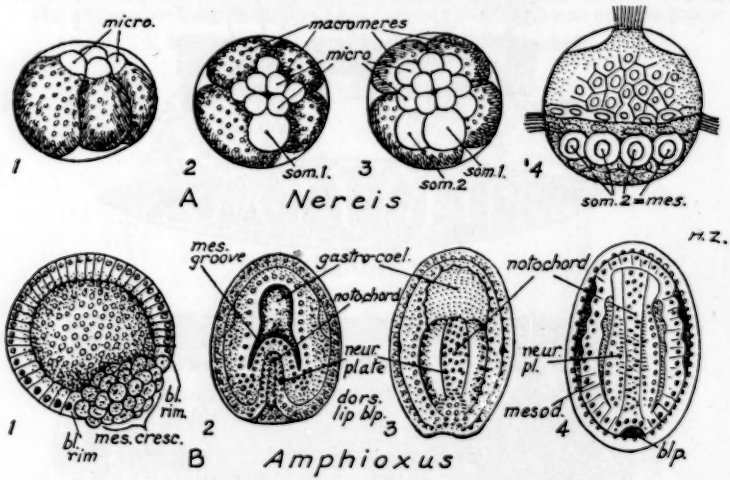


FIG. 5. ORIGIN OF MESODERM CELLS CONTRASTED IN A MARINE ANNELID AND AMPHIOXUS

A, Marine annelid; data from Parker and Haswell, after Westinghausen and E. B. Wilson. B, *Amphioxus*, after Conklin

FROM KOVALEVSKY AND METSCHNIKOFF TO GARSTANG AND DE BEER

Kovalevsky's classical studies (1866, 1871) on the development of the simple ascidians made familiar the "ascidian tadpole" and the idea that the ascidians are degenerate forms—vertebrates

fallen from their high estate. But the popular emphasis on the irrevocability of degeneration may have delayed a wider acquaintance with von Baer's principle of "paedogenesis" (1828) and Kollmann's "neoteny" (1882).

The so-called acorn worm (*Balanoglossus*) in its adult stage superficially resembles a worm (Fig. 6). It lives in muddy flats along the seashore, ingesting the mud and extracting organic particles from it. Within the neck of its so-called proboscis lies a small oesophageal diverticulum called the notochord. A small nerve cord is commonly identified as homologous with the dorsal nerve of *Amphioxus*. Numerous branchial hoops (Fig. 6) are homologized with the branchial arches of *Amphioxus*.

Different species of Balanoglossus (*sensu lato*) have different types of larvae (Fig. 12, C). In one group the development is indirect and the free-floating larva was once named *Tornaria* (Delage and Hérouard, 1898, pl. 10), but Metschnikoff (1866, 1870, 1881) and his successors showed that this form developed into an adult *Balanoglossus*.

In a second group (e.g., *B. kovalevskyi*), the development is direct, and the young larvae develop a tripartite segmentation, the cavities of the head, collar, and body being commonly equated with those of a young larva of *Amphioxus* (see Fig. 6). The Tornaria larva is so similar to those of echinoderms that Metschnikoff proposed (1881, p. 156) to unite the Enteropneusta (balanoglossids) and the echinoderms in a single major group, the Ambulacraria.

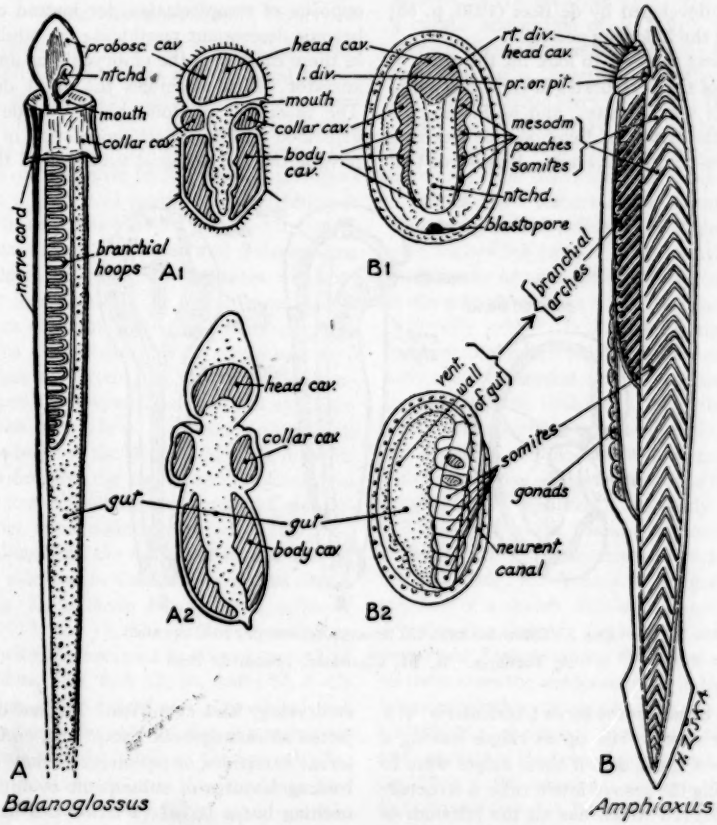


FIG. 6. BALANOGLOSSUS AND AMPHIOXUS
Data from McBride, Delage and Hérouard, Conklin

Thus the connection (Fig. 6) of *Balanoglossus* with *Amphioxus* is heavily masked by wide differences in habitus, while its connection with the echinoderms is not fully established, although probable.

Garstang (1894) suggested that the vertebrates has arisen through neoteny or paedomorphosis by emphasizing certain features seen in the larvae of both *Balanoglossus* (Fig. 7) and the echinoderms. This idea was developed by de Beer (1930, p. 65; 1938, p. 59) in the following passages:

"Garstang was the first to look for the trace of the ancestors of the vertebrates in early instead of adult stages of invertebrates; and he focused his attention on the larvae of Echinoderms (starfish, sea-urchins, sea-cucumbers, etc.). He showed that if the ciliated bands on the larva (Auricularia) of a sea-cucumber were to rise up as ridges leaving a groove between them, and if these ridges were to fuse, converting the groove into a tube, a structure would be produced which has all the relations of the vertebrate nervous system, including such details as the neurenteric canal. Not only this, but the two modifications of the vertebrate nervous system which are found in Amphioxus and all higher forms on the one hand and in sea-squirts on the other, can be based on differences which are found in the disposition of the ciliated bands on different kinds of Echinoderm larvae" (1930).

"There are indications that many important steps in evolution have resulted from novelties which first manifested themselves in early stages of development of the ancestors. Adult modern man finds the closest resemblance to himself in young Neanderthal man or in new-born apes; the only invertebrate forms from which the vertebrates may plausibly be derived are larval echinoderms; insects may likewise have been derived from larval myriapod-like forms."

"This phenomenon, to which Garstang (1922) has given the name 'paedomorphosis,' is the very opposite of recapitulation, for instead of the embryonic descendant resembling the adult ancestor in these cases it is the embryonic or undeveloped ancestor which resembles the adult descendant. The theory of paedomorphosis as de Beer has explained (1930) is much more fertile in providing possibilities for a logical synthesis of the data of embryology and evolution. Instead of being rejected as caenogenetic exceptions, embryonic and larval variations or persistencies may become the leading features of subsequent evolution. Thus, nothing but a larval variation can have brought about the torsion of gastropod molluscs" (1938).

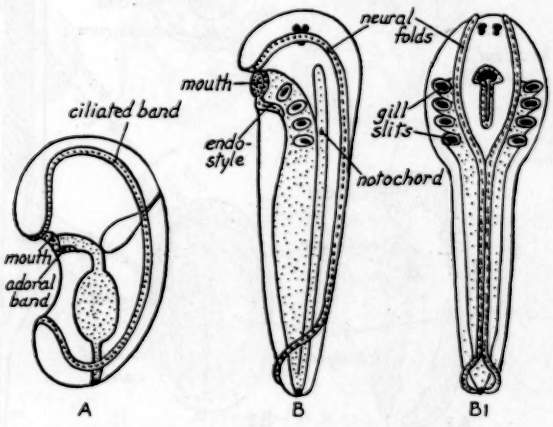


FIG. 7. TORNARIA INTO CHORDATE, ACCORDING TO GARSTANG
A, Tornaria. B, B1, Chordate. From de Beer

The paleontological evidence for the relationship of the chordates and the echinoderms is noted below, but even if the balanoglossids have but an imperfect claim to be related to either chordates or echinoderms, their Tornaria larva has at least given us a concrete picture of what a very remote invertebrate ancestor of the vertebrates may have been like in the larval stage. Moreover, the contrast between the indirect or Tornaria mode of development and the direct mode, in which larvae

resemble adults in basic features, shows what wide differences may occur in nearly related forms and indicates that in one case adult characters may be delayed and in another accelerated in development But such shifts are the cause of the phenomenon called neoteny, and much evidence indicates that this is one of the chief ways in which old groups have given rise to later and very different groups.

COMPARISON OF PALEOZOIC FISH-LIKE CHORDATES WITH PROCHORDATES

The ostracoderms from the Upper Ordovician, Silurian, and Devonian ages are the oldest known chordates, but for many decades they gave scant comfort to those who may have looked to them for a sign as to the source of the vertebrates. The best known ostracoderms had a large cephalothorax enclosed in a thick and complex exoskeleton; but most morphologists had looked to naked or nearly naked forms such as *Amphioxus* and *Balanoglossus* as indicating naked ancestral vertebrates. Paleontologists at first classified the ostracoderms as peculiar genera of ganoid fishes, and even when the ostracoderms at last came to be recognized as a separate class of vertebrates, they were long regarded as peculiarly specialized and not at all ancestral to the true fishes. However, the striking resemblance between the head shield of *Cephalaspis* and that of *Limulus* did not escape the keen eyes of either Patten or Gaskell. Patten used *Cephalaspis* and other ostracoderms very effectively, but since he realized that the shield in *Limulus* was on the haemal side and in *Cephalaspis* on the neural side (see Fig. 3), he made a remarkable series of diagrams (1912, pp. 17, 122, 355) purporting to show how, with the assumed backward growth of the brain (*idem*, Figs. 8, A–D; 56, A–D; 57, A–C) and migration of the paired eyes, the shield had also grown around the anterior rim, increasing on the neural side and shrinking on the haemal side, until it had moved around onto the vertebrate dorsal surface (Fig. 123, A–D). And such was his persuasiveness and the power of his beautiful and consistent drawings, that even unbelievers have been known to waver in their opposition to his theory.

Gaskell (1896, 1898) used the head shield of a cephalaspid (Fig. 8, A) as the homologue of part of the skeleton of the sucking-disc of the lamprey and recognized the basic similarity of the gills, semicircular canals, pineal eye, and general brain form, as indicated in the endocast of *Pteraspis*, with the corresponding parts of the larval lamprey, Ammocoetes.

One Devonian group of armored fish-like chordates, including *Pterichthys* and its American relative, *Bothriolepis*, were long included with the ostracoderms, but have lately been shown by Stensiö (1934) to be members of the next higher grade, or Placodermi, which had complex jaws of primitive vertebrate type. Patten was a great collector and student of *Bothriolepis* (Fig. 9). He made an accurate restoration of it (1912, pp. 368–375), correctly noting its relationship to the Arthrodira and deriving it, together with the ostracoderms, from the arachnid stem (p. 382). But, so far as I know, no contemporary paleoichthyologist would regard the few eurypterid-like characters of *Bothriolepis* as other than superficial habitus features.

The essential feature of the locomotor skeleton of arthropods is that it is an exoskeletal apparatus with superficial joints. The essential feature of the primary or axial locomotor skeleton of ostracoderms and placoderms is that it is endoskeletal and essentially spinal. In *Pterichthys* and *Bothriolepis* local pectoral outgrowths of the muscular body wall have used the exoskeletal plates as accessory fulcra for bending the limbs and have thus developed joints corresponding to but not fully analogous to the shoulder and elbow joints of tetrapod vertebrates; but the analogies with the large cephalic appendages of eurypterids are surely superficial.

The large brain of *Limulus* is securely lodged in a strong box, the endocranium (Patten, 1912, pp. 96, 315, 316), which broadly suggests the endocranium of a skate. But in its general body form *Limulus* also suggests *Cephalaspis* among ostracoderms and *Torpedo* among the skates and rays. In all these cases the endocranium is in the middle of a huge cephalothoracic shield and forms the center of a stiffening skeleton. Similarly, the radiating arrangement of the cranial nerves in *Limulus* (Patten, 1912, p. 96) somewhat suggests the pattern in *Cephalaspis* (Stensiö, 1927, p. 200), but only Patten would homologize the parts of the two systems.

Cope (1885), who well knew of Kovalevsky's work (1866, 1871) on the embryology of the ascidians, evidently saw in *Bothriolepis* (Fig. 9) something suggestive of that group, for, with his usual daring, he proposed to remove the pterichthyids from the Chordata to the Urochorda and referred them to "a second order Antiarchi, distinguished from other urochordates by the 'normal' (posterior) position of the anus." Hence the term *anti* (opposite) *archa* (anus).

On the tunicate side, however, the embryological evidence (Fig. 12, D) suggests only that the brain of the ancestral tunicate stock was of low invertebrate grade, sufficient for the guidance of a larva with a vibratile tail but by no means suitable for a chordate with even incipient jaws and large eyes, such as *Bothriolepis*.

struction of the motile larva itself, which soon puts forth adhesive processes, becomes attached, and undergoes a transformation. In *Appendicularia* and its allies the tailed larva retains its loop-like gut but carries reproductive organs and is functionally an adult; it also keeps its motile character, while the thick test has become a filmy,

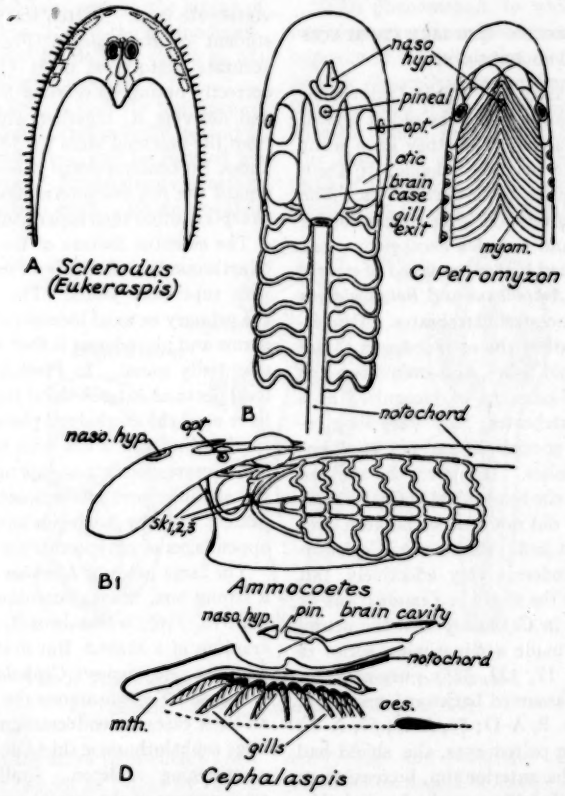


FIG. 8. A COMPARISON OF CEPHALASPID SHIELDS WITH THE HEAD SKELETON OF THE LARVAL AND THE ADULT LAMPREY

A, D, Cephalaspid shields. B, B1, Larval lamprey. C, Adult lamprey. Data after Powrie and Lankester (A), Gaskell (B, B 1), Stensiö (D), and Evans (C)

It is commonly assumed that the ascidians are "degenerate chordates" because, it is further assumed, the free-swimming larvae, by recapitulation, are repeating past adult stages. In the great development of their branchial pharynx the ascidians do indeed recall *Amphioxus*, which is free-swimming in both larval and adult stages. That the adult ascidians have been sessile forms for a very long period is suggested even by the con-

floating bag (Delage and Hérouard, 1898, fig. 123). The enormous ascidian pharynx, by further improvement in other tunicates, acquires contractile muscular rings, which may pulsate like single barrels or bud into long salp chains or group themselves into radiate-octacnemids.

Underneath all this adaptive diversity lies the heritage of a sessile habitus, with twisted or loop-like gut, and with or without a motile larva

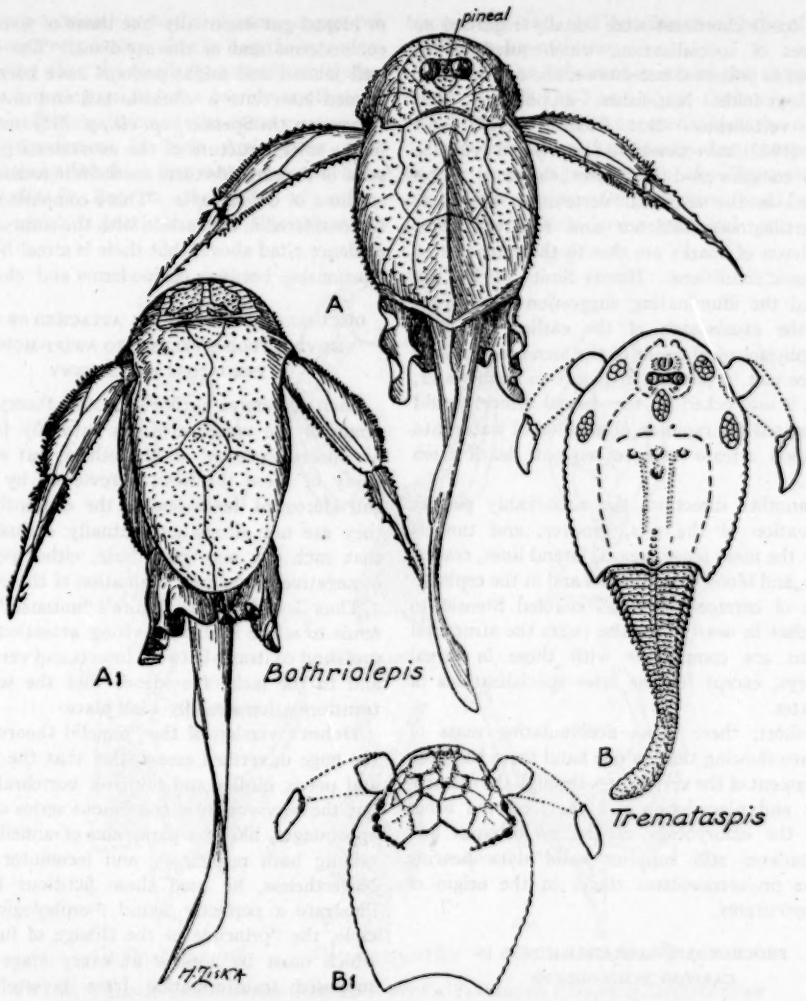


FIG. 9. AN ANTIARCH PLACODERM AND A CEPHALASPID OSTRACODERM

A, A1, Antiarch placoderm. B, B1, Cephalaspid ostracoderm. After Patten

Like many other forwardly moving aquatic animals, these forms were bilaterally symmetrical, dorso-ventrally contrasted, and cephalo-caudally differentiated. The body included a well defined armored head, a fixed thoraco-abdominal section and a sweep-like tail. From these simple conditions spring not a few of the resemblances between these early vertebrates and certain arthropods (cf. Fig. 3, C). The supposed pectoral appendages ascribed to *Trematapis* by Patten, according to good authorities (Hussakof, Robertson) do not belong to it. Moreover, they were wrongly restored by Patten as articulating with what is certainly one of the outer gill openings (cf. Fig. 11, C).

having a vibratile tail or stalk. The nearest analogies seem to be among the carpoid echinoderms, but that the vibratile tail of the ascidian tadpole has been derived from the stalk of an echinoderm remains to be proved.

RELATIONSHIPS OF THE OSTRACODERMS AND PLACODERMS TO OTHER FISH-LIKE CHORDATES

Until the researches by Stensiö and others on the ostracoderms and placoderms, the diverse body forms and exoskeletons of these earliest

known fossil chordates were usually regarded as evidences of specialization, which ruled all of them out as potential ancestors of the cyclostomes, sharks, ganoids, lung-fishes, amphibians, and higher vertebrates. But Stensiö (1927) and Romer (1942) have assembled impressive evidence that a complex and hard exoskeleton is to be expected in the ancestral vertebrates and that the cartilaginous skeleton and relatively thin exoskeleton of sharks are due to the retention of embryonic conditions. Homer Smith (1939) has supplied the illuminating suggestion that originally the exoskeleton of the earlier chordates was a physiological result of the increased osmotic pressure met in passing from salt to fresh water, which, if unchecked by the dermal armor, would have caused too rapid an absorption of water into the blood stream and consequent death from edema.

In another direction, the remarkably perfect preservation of the pits, grooves, and tunnels left by the main sense organs, lateral lines, cranial nerves, and blood vessels, upon and in the cephalothorax of ostracoderms, has enabled Stensiö to show that in nearly all these parts the structural patterns are comparable with those in larval lampreys, except for the later specializations of the latter.

In short, there is an accumulating mass of evidence showing that on one hand there has been a real ascent of the vertebrates through the ostracoderms and placoderms and that, on the other hand, the embryology of the cyclostomes and prochordates still supplies valid data bearing on the pre-ostracoderm stages in the origin of the vertebrates.

PROCHORDATE-LIKE CHARACTERS IN CARPOID ECHINODERMS

The carpoid echinoderms, dating back to Mid-Cambrian times, lacked the sharp definition of the five-rayed symmetry of typical later echinoderms (Fig. 10, A-D). Some of them were pear-shaped or bag-like forms, others globular with a jointed stalk. Some had protrusile tentacles, others had one or two finger-like prolongations of the test called brachioles. Torsten Gislén (1930) noted that in *Cothurnocystis* the test was distinctly lopsided and that on one side there was a series of small openings, which he compared with the gill openings of the larval *Amphioxus*. In his restoration of *Gyrocystis* (Fig. 11, A), W. K. Spencer (in de Beer, 1938, pl. I) figures a twisted or looped gut essentially like those of some other echinoderms and of the ascidians. The stalk is well jointed and might perhaps have been transformed later into a vibratile tail and notochord. Heaseman (in Spencer, *op. cit.*, p. 293) notes that in the microstructure of the exoskeletal plates of some of the carpoids there are definite resemblances to those of *Cephalaspis*. These comparisons may be considered in connection with the embryological evidence cited above, that there is a real if remote relationship between echinoderms and chordates.

DISCUSSION AND SUMMARY: ATTACHED OR SLOW-MOVING FOOD-SIFTERS INTO SWIFT-MOVING PREDATORS BY NEOTENY

Each successive author of a new theory of the origin of the vertebrates has naturally felt that his theory excluded all the others, but repeated study of these theories, as reviewed by Delage and Hérouard, leads one to the conception that they are not altogether mutually exclusive and that each one may contribute, either positively or negatively, to a new evaluation of the evidence.

Thus Geoffroy Saint-Hilaire's "notonect" theory tends to refute itself by inviting attention to the profound contrasts between insects and vertebrates and to the lack of evidence that the suggested transformation actually took place.

Dohrn's version of the "annelid theory" made the huge unverified assumption that the pectoral and pelvic girdles and limbs of vertebrates were but the survivors of a continuous series of paired appendages, like the parapodia of annelids, containing both respiratory and locomotor organs. Nevertheless, he used these fictitious ideas to illustrate a perfectly sound morphological principle, the "principle of the change of function," which must be applied at every stage of any supposed transformation from invertebrate to vertebrate.

Similarly, all those who have chosen any particular type of the higher jointed animals as a starting-point for the vertebrates have necessarily directed attention to the great apparent difficulties in transforming the arthropod nervous system into that of the vertebrate plan. Nor do the irreconcilable solutions proposed by Patten and Gaskell, who started from the same forms but reached the vertebrates by wholly different ways, inspire confidence that either proposed transformation really occurred.

And even the ingenious identification and naming of parts by which Patten sought to equate

severally the cranial nerves and sense organs of *Limulus* and vertebrates always beg the question by assuming that the similarly named structures are truly homologous and not merely analogous. Patten, finding evidence of the concrescence of cephalic neuromeres in both Arthropoda and Chordata, brigaded them into a new superphylum "Syncephalata." But in the light of other evidence, which is partly cited in this paper, it now seems more probable that the complex arthropod head was not transformed into the still more complex chordate head, but that each was built up in its own way according to the different chemico-physical and biological necessities and opportunities of each.

If we do not have to derive the vertebrates from any invertebrates with an already complex head, the way is opened to deriving them from some lowly and still headless members of their own enteroblastic series.

Here lies an apparent merit of the theories of Garstang and De Beer, which derive both the vertebrates and their supposed allies, the echinoderms, from some unknown but excessively simple creatures not unlike the Tornaria and echinoderm larvae. On the other hand, so far as is known, these larvae were only the young stages of quite complex adults, and the main question is still from what *adult* invertebrate type the adult vertebrate forms were derived.

Most authorities have held or have implied that such free-floating sac-like creatures as the trochophore larvae and Tornaria are necessarily more primitive than the adults, partly because they are structurally nearer to the free-floating coelenterates and partly because they occur at an

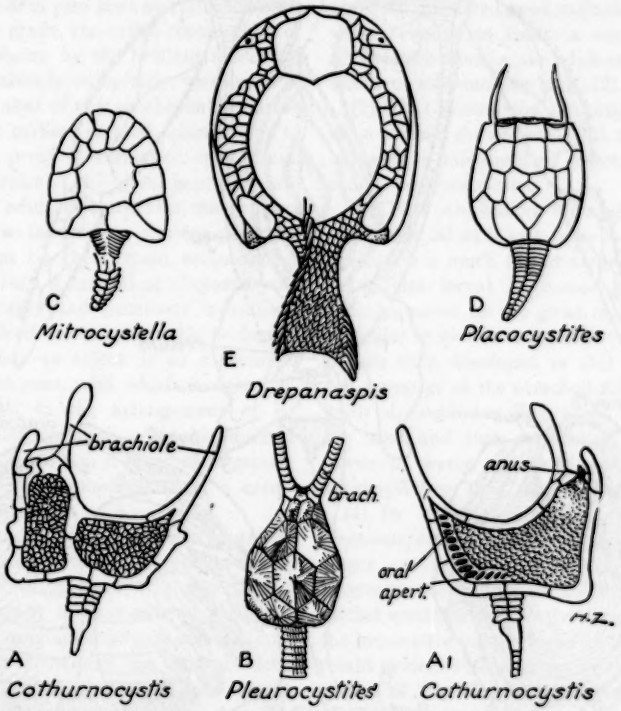


FIG. 10. CARPOID ECHINODERMS COMPARED WITH A FLATTENED PTERASPID OSTRACODERM

A-D, Carpoid echinoderms. E, Pteraspid ostracoderm. That the general resemblances between C, D, and E are not merely habitus analogies is made more probable by the general background of evidence tending to eliminate from relationship with the chordates all other phyla than the echinoderms. A-D, from Zittel; E, from Goodrich after Traquair.

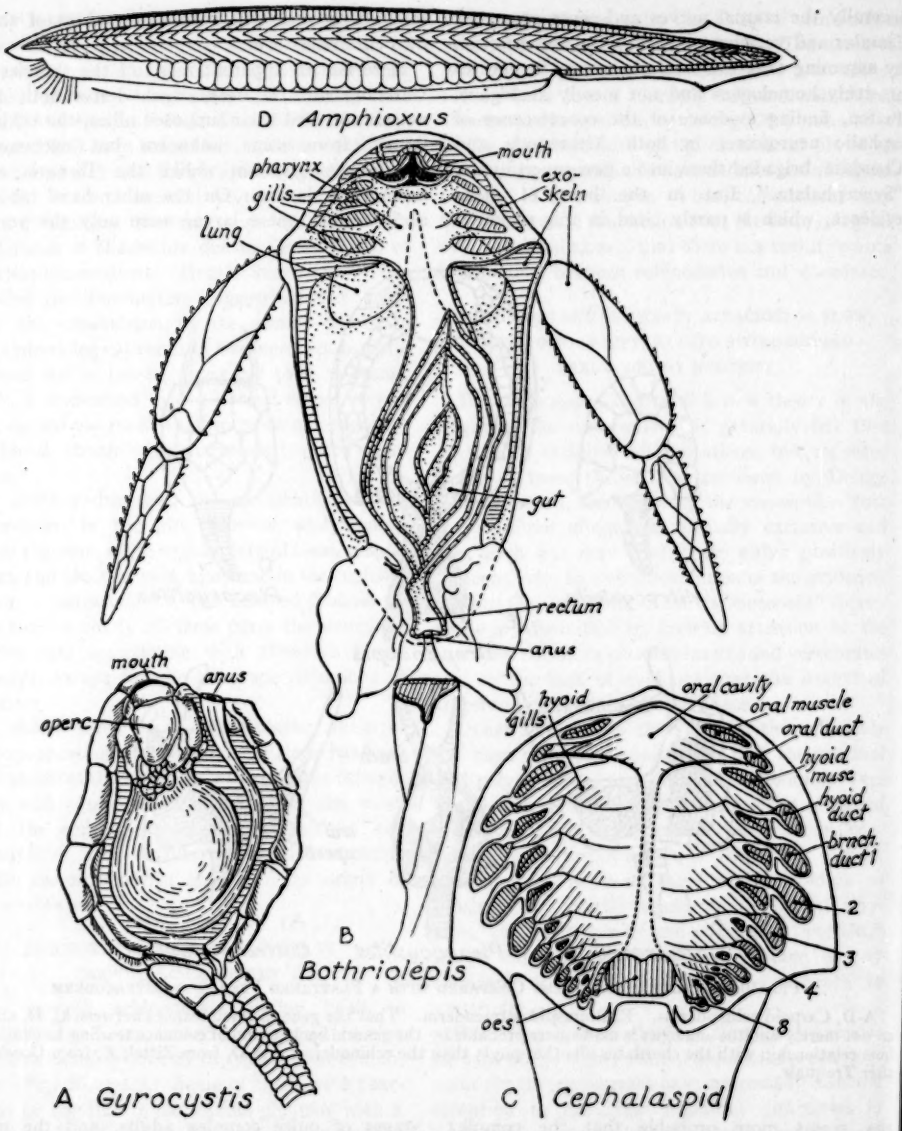


FIG. 11. CARPOID ECHINODERM COMPARED WITH EARLY CHORDATES

A, Carpoid echinoderm, *Gyrocystis*, after W. K. Spencer. B, C, Early chordates: B, *Bothriolepis*, after Denison; C, Cephalaspid, after Stensiö. D, *Amphioxus*, after Delage and Hérouard. Showing the already great advance of the early chordates beyond the carpoid grade in the evolution of the oralo-branchial organ and the dominance of the vertebrate locomotor system, with a flexible axis extending to or into the head. *Amphioxus* illustrates also the strong dorso-ventral differentiation and the downgrowth of the dorsally arising locomotor system around the nutritive and reproductive systems.

earlier stage of individual development. This may well be true as to very early arcestors, but there may still be reason to suggest that the attached hydroid may be a more primitive form

as an adult than its free-floating strobilae. Strobilization, metamerism, or polyisomerism may be evolved independently in fixed, floating, or actively swimming forms.

Turning to the vertebrates, it seems highly probable that the earliest ostracoderms were rather slow-moving, well encrusted forms, clinging to the bottom and drawing in food-bearing currents either by ciliary action or by rhythmic rise and fall of the throat. But long before some of them changed the oral arch into jaws and thus attained the gnathostome grade, the entire construction of their heads, as shown by the brilliant researches of Stensiö, was already completely vertebrate in grade, far above that of any prochordate and too distant from the earliest carpoid echinoderms to afford a definite proof of derivation from them. Nevertheless, in spite of this great gap, there are no other known adult invertebrates that appear to afford nearly so favorable a starting-point for the vertebrates as do the carpoid echinoderms.

The fact that such a carpoid as *Cothurnocystis* appears to be highly and peculiarly specialized would probably lead many systematic zoologists and paleontologists to reject it as a possible ancestor of *Amphioxus*, with which it agrees in its assymetry and in the arrangement of its supposed "branchial" openings. But this assumed phylogenetic transformation is perhaps no greater than the ontogenetic metamorphosis of a caterpillar into a butterfly.

In past decades morphologists who have striven to locate the ancestors of the vertebrates in one or another invertebrate phylum did not expect such ancestors already to have a head and locomotor system of fundamentally chordate type, such as would be demanded by those modern systematists who require that even very remote ancestors must at least foreshadow their descendants in essential features. But this unwarranted extrapolation backward of a given status would lead to the probable anachronism that the chordates themselves are of equal antiquity with other phyla and that all phyla must have sprung independently and at the beginning from some unknown and primordial forms of living cells. The researches of embryologists and cytologists have strengthened the evidence that certain single-celled protozoans subdivided into colonies, that much later there arose "two-layered" animals of the coelenterate grade, and that these gave rise to triploblastic forms which in turn soon divided into the teloblastic and enteroblastic series. Of these, the vertebrates appear to be most nearly related to the echinoderms.

From this point the eclectic theory herein developed proceeds to set forth the following observations and provisional hypotheses:

(1) That, notwithstanding the wide diversification of the adult forms among the echinoderms into sessile, stalked, and slow-moving animals, all developed free-floating larvae, which appear to serve as animated seed capsules. These scatter widely enough to secure a necessary percentage of favorable sites for the adult reproductive phase, sessile or slow-moving (Fig. 12).

(2) That among the tunicates the larvae may have utilized the ancient stalk as a vibratile tail, but with a minimum of directive organs in the central nervous system.

(3) That *Amphioxus*, although possibly degenerate in so far as it may have lost its exoskeleton, represents a much higher stage than the echinoderms, its larval locomotor apparatus having been improved by the great multiplication of the muscular coelomic segments. By neoteny the gonads then developed in this locomotor stage, but a vestige of the attached stage is seen in the habit of *Amphioxus* (Fig. 12, E 1) of darting into the sand and then protruding its head, which draws in water and food particles by ciliary action (Willey, 1894, Frontispiece).

(4) In such slow-moving ostracoderms as *Drepanaspis* and *Cephalaspis* the larval locomotor stages are still unknown, but in the modern lampreys, which appear to be degenerate and further specialized derivatives of the ostracoderms, the locomotive larval stages are truly jawless and retain evident resemblances to the oralobranchial system of *Cephalaspis*, while the development of the naso-pituitary sac shows how, by a great increase in size of the "upper lip" behind the naso-pituitary sac, the latter became displaced on to the top of the skull, where it is found in cephalaspids. Thus the Ammocoetes larva of the recent lampreys on the one hand tends to connect the cyclostomes with the ostracoderms, and on the other recalls *Amphioxus* in important features. But even the adult cephalaspids were mud-grubbers or at best incipient predators, utilizing a part of the aerating and food-sucking oralobranchial basket for pulsating or pumping movements. In *Bothriolepis* there was a further differentiation of jaws from the other visceral

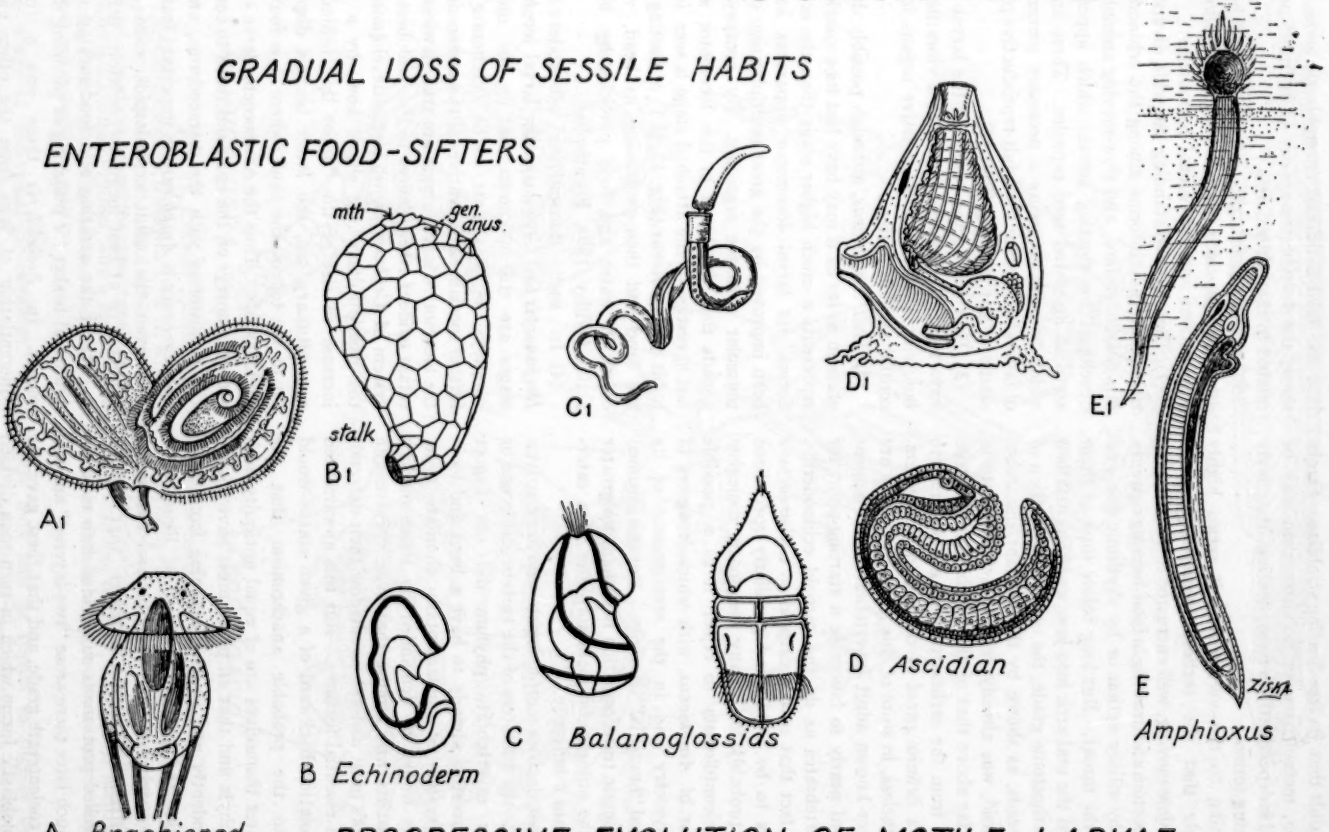


FIG. 12. FROM ANIMATED SEED-CAPSULE TO MOTILE ADULT BY NEOTENY

arches, so that (as observed by Stensiö) it became a true gnathostome.

(5) Thus both fixed adults and motile larvae may have played important roles in the origin of the vertebrates from such attached enteroblastic forms as the earliest carpoid echinoderms. The metameric locomotor system was developed in the motile larvae before the fixed stage was eliminated by neoteny.

(6) The expanded oralo-branchial pharynx of the ostracoderm, at first a relic of the old attached stage, through a change of function gave rise on the one hand to specialized jaws, and on the other hand to improved respiratory organs.

LIST OF LITERATURE

ALLEE, W. C. 1927. The evolution of the invertebrates. In *The Nature of the World and of Man*, H. H. Newman, ed. Univ. Chicago Press, Chicago. Pp. 260–303.

BAER, K. E. VON. 1828. Ueber Entwicklungsgeschichte der Thiere. *Beobachtung und Reflexion*, Königsberg.

BALFOUR, F. M. 1875. Comparison of the early stages in the development of vertebrates. *Quart. J. micr. Sci.*, 15 (n.s.): 207–226.

——. 1880–1881. *A treatise on comparative embryology*. Vols. I, II. Macmillan, London.

BATESON, W. 1884. The early stages in the development of *Balanoglossus* (*sp. incert.*). *Quart. J. micr. Sci.*, 24: 207–235.

——. 1885. The later stages in the development of *Balanoglossus Kovalevskyi;* with a suggestion on the affinities of the Enteropneusta. *Quart. J. micr. Sci.*, 25, suppl.: 81–122.

——. 1886. Continued account of the later stages in the development of *Balanoglossus Kovalevskyi* and of the morphology of the Enteropneusta. *Quart. J. micr. Sci.*, 26: 512–533.

——. 1914. Address of the President of the British Association for the Advancement of Science. *Nature, Lond.*, 40: 287–302.

BEARD, J. 1886. Some annelidan affinities in the ontogeny of the vertebrate nervous system. *Nature, Lond.*, 39: 259.

——. 1888. The old mouth and the new: A study in vertebrate morphology. *Anat. Anz.*, 3: 15–24.

BEER, G. R. DE. 1928. *Vertebrate Zoology: An introduction to the comparative anatomy, embryology, and evolution of chordate animals*. Macmillan, New York.

——. 1930. *Embryology and evolution*. Clarendon Press, Oxford.

——. 1938. Embryology and evolution. In *Evolution: Essays on aspects of evolutionary biology presented to Prof. E. S. Goodrich on his seventieth birthday*, G. R. de Beer, ed. Clarendon Press, Oxford.

——. 1940. *Embryos and ancestors*. Clarendon Press, Oxford.

BROOKS, W. K. 1899. *Foundations of zoology*. Macmillan, New York.

CONKLIN, E. G. 1932. The embryology of *Amphioxus*. *J. Morph.*, 54: 69–151.

——. 1933. The development of isolated and partially separated blastomeres of *Amphioxus*. *J. exp. Zool.*, 64: 303–375.

COPE, E. D. 1885. The position of *Pterichthys* in the system. *Amer. Nat.*, 19: 289–291. [Proposes Antiarcha as an order of Tunicata, p. 291.]

DELAGE, Y., and E. HÉROUARD. 1898. Les Procordés. In *Traité de Zoologie Concrète*, by Delage and Hérouard, vol. 8. Schleicher Fr., Paris.

DENISON, R. H. 1941. The soft anatomy of *Bothriolepis*. *J. Palaeont.*, 15: 553–561.

DOHRN, A. 1875. *Der Ursprung der Wirbelthiere und das Princip des Functionswechsels: Genealogische Skizzen*. Wilhelm Engelmann, Leipzig.

GARSTANG, W. 1894. Preliminary note on a new theory of the phylogeny of the Chordata. *Zool. Anz.*, 444: 122–125.

——. 1922. The theory of recapitulation: A critical restatement of the biogenetic law. *J. Linnean Soc. Lond., Zool.*, 35: 81.

GASKELL, W. H. 1896. The origin of Vertebrates. *Proc. Cambridge philos. Soc.*, 9: 19–47.

——. 1898–1906. On the origin of vertebrates deduced from the study of ammocoetes. *J. Anat. Physiol., Lond.*, 1898–1906.

——. 1908. *The origin of vertebrates*. Longmans, Green, London.

GEOFFROY SAINT-HILAIRE, ÉTIENNE. 1818. *Philosophie anatomique. Tome Premier. Des organes respiratoires sous le rapport de la détermination et de l'identité de leurs pièces osseuses*. J. B. Baillière, Paris. [Principle of unity of plan.]

——. 1830. *Principles de philosophie zoologique, discutés en Mars 1830, au sein de l'Académie Royale des Sciences*. Pinchon et Didier, Paris.

GEOFFROY SAINT-HILAIRE, ISIDORE. 1847. *Vie, travaux et doctrine scientifique d'Étienne Geoffroy Saint-Hiliare*. P. Bertrand, Paris. [See p. 249; also see bibliography for further references.]

GISLÉN, TORSTEN. 1930. Affinities between the Echinodermata, Enteropneusta and Chordonia. *Zool. Bidrag. Uppsala*, 12: 199–304.

GOODRICH, E. S. 1895. On the coelom, genital ducts and nephridia. *Quart. J. micr. Sci.*, 37: 477–510.

——. 1909. Vertebrata Craniata. First Fascicle: Cyclostomes and fishes. In *A Treatise on Zoology*, Sir Ray Lankester, ed., Part 9. London.

FIG. 12. FROM ANIMATED SEED-CAPSULE TO MOTILE ADULT BY NEOTENY

GOODRICH, E. S. 1830. *Studies on the structure and development of vertebrates.* Macmillan, London.

GREGORY, W. K. 1935. Reduplication in evolution. *Quart. Rev. Biol.*, 10: 272–290.

HUBRECHT, A. A. W. 1883. On the ancestral forms of the Chordata. *Quart. J. micr. Sci.*, 23: 349–368.

——. 1887. The relation of the Nemertea to the Vertebrata. *Quart. J. micr. Sci.*, 26: 605–644.

KIAER, JOHAN. 1928. The structure of the mouth of the oldest known vertebrates, pteraspids and cephalaspids. *Palaeobiologica*, 1: 117–134.

KOLLMANN, J. 1882. Das Ueberwintern von Frosch- und Tritonlarven und die Umwandlung des mexikanischen Axolotl. *Verh. naturf. Gesell. Basel*, 7: 387.

KOVALEVSKY, A. 1866. Entwickelungsgeschichte der einfachen Ascidien. *Mem. Acad. Sci. Saint-[Pëtersb.*, ser. 7, 10: 1.

——. 1871. Weitere Studien über die Entwickelung der einfachen Ascidien. *Arch. mikr. Anat.*, 7: 101–130.

KUPFER, C. 1870. Die Stammverwandtschaft zwischen Ascidien und Wirbelthieren. *Arch. mikr. Anat.*, 6: 115–172.

LANG, ARNOLD. 1894. *Lehrbuch der Vergleichenden Anatomie der Wirbellosen Thiere.* 4 Theil. Kap. VIII, IX. Echinodermen und Enteropneusten. G. Fischer, Jena.

——. 1921. *Handbuch des Morphologie des Wirbellosen Tiere.* Continued by Karl Hescheler. 4 Bd. Arthropoda. G. Fischer, Jena.

LANKESTER, RAY. 1877. Notes on embryology and classification. *Quart. J. micr. Soc.*, 17: 399.

MCBRIDE, E. W. 1896. Note on the formation of the germinal layers in *Amphioxus. Proc. phil. Soc. Cambridge*, 9: 151–153.

——. 1898. The early development of *Amphioxus. Quart. J. micr. Soc.*, 40: 589–613.

——. 1914. *Text-book of embryology.* Vol. I. Invertebrata. Macmillan, London.

MASTERMAN, A. T. 1898. On the Diplochorda. *Quart. J. micr. Sci.*, 40: 281–366. [Bateson's genetic distinction between "segmented" Invertebrata and segmented Vertebrata, p. 330.]

METSCHNIKOFF, E. 1866. Ueber eine Larve von *Balanoglossus. Arch. Anat. Physiol.*, Jahrg. 1866: 592–595.

——. 1870. Untersuchungen über die Metamorphose einiger Seethiere. 1. Ueber Tornaria. *Z. wiss. Zool.*, 20: 131–144.

——. 1881. Über die systematische Stellung von *Balanoglossus. Zool. Anz.*, IV Jahrg.: 139, 153–157. [Unites Enteropneusts and Echinoderms into one group, Ambulacraria.]

MINOT, C. S. 1897. Cephalic homologies: A contribution to the determination of the ancestry of vertebrates. *Amer. Nat.*, 31: 927–943.

MORGAN, T. H. 1891. Growth and development of Tornaria. *J. Morph.*, 5: 407–458.

——. 1894. The development of *Balanoglossus. J. Morph.*, 9: 1–86.

——. 1932. *The scientific basis of evolution.* W. W. Norton, New York.

OWEN, RICHARD. 1883. Essays on the conario-hypophysial tract and the aspects of the body in vertebrate and invertebrate animals. Privately printed, London.

PARKER, T. J. and W. A. HASWELL. 1897. *A Text-book of zoology.* Vol. I. Macmillan, London.

PATTEN, WILLIAM. 1884. The development of phryganids, with a preliminary note on the development of *Blatta Germanica. Quart. J. micr. Sci.*, 24 (n.s.): 549–602.

——. 1891. On the origin of vertebrates from arachnids. *Quart. J. micr. Sci.*, 31: 317–378.

——. 1902. On the structure and classification of the Trematapidae. *Amer. Nat.*, 36: 379–393.

——. 1903. On the structure of the Pteraspidae and Cephalaspidae. *Amer. Nat.*, 37: 827–865.

——. 1912. *The evolution of the vertebrates and their kin.* Blakiston, Philadelphia.

ROMER, A. S. 1942. Cartilage an embryonic adaptation. *Amer. Nat.*, 76: 394–404.

SEDGWICK, A. 1884. On the origin of metameric segmentation and some other morphological questions. *Quart. J. micr. Sci.*, 24: 43–82.

SEMPER, C. 1875–1876. *Die Verwandtschaftsbeziehungen der gegliederten Thiere.* Arbeit. zool.-zoot. Inst., Würzburg.

SMITH, HOMER W. 1939. *Studies in the physiology of the kidney.* Univ. of Kansas, Lawrence.

SPENCER, W. K. 1938. Some aspects of evolution in Echinodermata. In *Evolution: Essays on aspects of evolutionary biology presented to Prof. E. S. Goodrich on his seventieth birthday*, G. R. de Beer, ed. Clarendon Press, Oxford.

STENSIÖ, ERIK A:SON 1927. *The Downtonian and Devonian Vertebrates of Spitsbergen. Part I. Family Cephalaspidae.* A. Text. B. Plates. Jacob Dybwad, Oslo.

——. 1934. On the Placodermi of the Upper Devonian of East Greenland. I. Phyllolepida and Arthrodira. *Med. Grønland*, 97: 1–58.

WILLEY, A. 1894. *Amphioxus and the ancestry of the vertebrates.* Macmillan, New York.

WILSON, E. B. 1892. The cell-lineage of *Nereis:* A contribution to the cytogeny of the annelid body. *J. Morph.*, 6: 361–480.

ZITTEL, K. A. VON. 1924. *Grundzüge der Paläontologie* (Paläozoologie). I. Abteilung: Invertebrata. Revised by Ferdinand Broili. R. Oldenbourg, Munich; Berlin.

NEW BIOLOGICAL BOOKS

The aim of this department is to give the reader brief indications of the character, the content, and the value of new books in the various fields of Biology. In addition there will frequently appear one longer critical review of a book of special significance. Authors and publishers of biological books should bear in mind that THE QUARTERLY REVIEW OF BIOLOGY *can notice in this department only such books as come to the office of the editor. The absence of a book, therefore, from the following and subsequent lists only means that we have not received it. All material for notice in this department should be addressed to B. H. Willier, Editor of* THE QUARTERLY REVIEW OF BIOLOGY, *Department of Biology, Homewood Campus, The Johns Hopkins University, Baltimore 18, Maryland, U. S. A.*

REVIEWS AND BRIEF NOTICES

GENERAL BIOLOGY: PHILOSOPHY AND EDUCATION

INTERNATIONAL RELATIONS IN SCIENCE: *A review of their aims and methods in the past and in the future. Chronica Botanica, Volume 9, Number 4.*

By Walter B. Cannon and Richard M. Field. The Chronica Botanica Company, Waltham, Massachusetts; Division of Foreign Relations of the National Research Council, Washington, D. C. Free upon request (paper). Pp. 251–298. 1945.

One of the last products of the broad activities of Walter B. Cannon was this brochure that considers international relations in science during the war period. Richard Field has contributed a great deal of time and effort to summarizing the replies received to inquiries sent to the officers of international scientific unions and certain of the international congresses, and to rewriting the preliminary draft of the report. The most active international unions, from 1919 to 1944, appear to have been those of Astronomy, Chemistry, Geodesy and Geophysics, and Biology, the least active that of Pure and Applied Physics. Of all the natural sciences, biology appears to offer the most promising opportunity for "promoting the welfare and comity of nations." Yet international relations in this field have remained largely unorganized or have been temporary in character, as in the arrangements for the International Congresses of Physiologists or of Genetics. There seems to be, at least in the United States of America, a widespread distrust of permanent, quasi-governmental International Scientific Unions; and the government-organized Congresses, such as the Eighth American Scientific Congress, held in 1939, hardly appear to most biologists to have been worth the considerable expenditure they have involved.

Perhaps the most interesting thing about the report is the striking relation between the character of the officers of international scientific unions and the results achieved by the unions. Often the activity of a particular union appears to have depended almost entirely on the energy and vision of one or two men alone. In the affairs of the International Union of Biological Sciences, for example, it is apparent that botanists, led by E. D. Merrill, F. Verdoorn, and E. L. D. Seymour, and medical scientists, led by W. B. Cannon, have been alert and active participants; whereas zoologists hardly seem to have known that the organization existed.

The report recommends that the international scientific unions should be strengthened, in order to promote international cooperation in science, and that defects due to political jealousies arising from national pride, over-emphasis on the representation of national institutions rather than sciences, rivalry between national groups for the disposal of funds, and the indifference and inefficiency of national committees should be given attention and reduced to a minimum. It is further recommended that the organization of International Scientific Congresses be in future kept in the hands of scientists rather than arranged by government. There is a strong preference among certain British and American scientists for the organization of International Scientific Conferences by national private organizations, such as the Academies of Science.

In an appendix there is an interesting summary and critique of Joseph Needham's memorandum on "The Place of Science and International Scientific Cooperation in Post-War World Organization." The importance of Joseph Needham's efforts and of this report by Cannon and Field in bringing about the inclusion of the sciences in UNESCO deserve to be recognized.

BENTLEY GLASS

SCIENCE, LIBERTY AND PEACE.

By Aldous Huxley. Harper & Brothers, New York and London. $1.00. 86 pp. 1946.

This essay both begins and ends with a quotation. It

affords an excellent illustration of the way in which a brilliant intellect can arrive at a sound and solid conclusion after starting from a faulty premise.

Aldous Huxley, like a good physician, attempts to make a diagnosis of the ills of the world before prescribing a treatment. He applies his figurative stethoscope and thermometer, and he feels the rhythmic pulse of events that shake the cosmos, and he then declares that that civilization is suffering from too much minority rule. So, too, declared Tolstoy in the quotation with which Aldous Huxley introduces his thesis, completely unmindful that what may have been true of Russia in the nineteenth century is not necessarily true of North America (or Europe) in the twentieth.

If by minority rule the author simply meant that in an empire like ours the number of those actually engaged in the business of political administration is but a small portion of the entire population, his statement would be a truism. But that is apparently not what he means. He seems to wish to imply that the Federal Government is not representative of the people as a whole. To the reviewer, and to many another American, it appears that the trouble with Congress is that it is only too representative. Its IQ is about as low as, although no lower than, that of its constituency. The superior element in the population votes for people like itself, but because it is a minority group it never elects its candidates. As a result, the minority groups, instead of ruling the nation as Huxley seems to believe, in reality can take no part in its management. One such minority group is that of the Negro, and Negroes have never been plentiful in Congress. Congress becomes vociferous over each lynching but takes no action. Another minority group is that of the Nisei. There have never been any Nisei in Congress. When the War Department uproots over one hundred thousand Nisei from their homes and drives them into concentration camps, Congress fears to speak. Conscientious objectors are also a minority group, one without congressional representation. The same Congress which declares their work to be of national importance and enacts legislation to provide compensation for it also refuses to make an appropriation from which such compensation could be paid, and thus re-establishes what has been euphoniously called involuntary servitude. Is it not all because the puppet-strings by which Congress is actuated are held in the hidden hands of a majority of people who not only look alike but talk alike and think alike, if they ever think at all?

But enough of this digression! Suffice it to say that the author, having announced his text, proceeds to forget all about it, and, freed of the necessity of tying his discourse to it, produces a thoroughly worth-while piece of reading. His discussion of centralized industry and finance, of capitalist sabotage, and of non-cooperation is extremely timely, and thoroughly sane and appreciative. So is his condemnation of materialistic philosophy.

A generation ago it was believed that the advancement of science would provide a panacea for all the evils that civilization is heir to. Today we are hardly so naive. We know now that scientific knowledge is in itself good or bad only in so far as the individual scientist is good or bad. Scientific research is neither moral nor immoral; it is only unmoral. As long as institutions of scientific research are subsidized by a centralized national government they will be controlled by the centralized national government, and as long as this in turn is controlled by a dictator with the mentality of a fourteen-year-old delinquent and the ethics of a gangster, just so long will science be prostituted to evil ends.

The opportunity to do good is also the opportunity to do evil. The scientist, as scientist, has no choice but to follow Truth whithersoever the search may lead. But the scientist is also a human being who must assume the responsibility of a human being—and this includes the duty to know the difference between right and wrong, and to choose the right and reject the wrong. The scientist has sometimes been slow to meet his obligations.

Aldous Huxley's suggested remedy is for every student engaged in scientific research to take an oath similar to that which all medical practitioners have been accustomed to take since the time of Hippocrates. Such an oath should bind him to use his knowledge, his skill, and his experience in the service of good for humanity, and not in that of evil. There is nothing new in this suggestion. The author gives credit where credit is due, and acknowledges his debt to Gene Weltfish in particular. We must remember that Huxley has a clientele that is not likely to read Weltfish, and this book will have been worth-while if it succeeds in guiding the feet of even a few into the way of peace.

ENDLESS HORIZONS.

By Vannevar Bush; introduction by Frank B. Jewett. Public Affairs Press, Washington, D. C. $2.50. ix + 182 pp. + 1 plate. 1946.

This collection of writings by the eminent head of the Carnegie Institution of Washington and Director of the Office of Scientific Research and Development during the war period will be of profound interest to all scientists who are interested in the role of research in the war effort and who are concerned about the future development of government support of science. No one in America has had a greater responsility or has wielded more influence in determining the nature of the measures used in war and proposed for the peace in this relationship than Vannevar Bush.

The collection begins with an entertaining essay, dating back to 1933, that describes how the material and technological state of the 30's will seem to a scientist engineer of, say, a hundred years hence.

There follows a reprinting of the more recent article from the Atlantic Monthly in which Bush describes feasible methods for organizing, recording, and using for reference the voluminous notes and printed material every professional worker needs in a lifetime. Photographic recording by dry photography, compression onto microfilm, machines that will type speech, mathematical machines of great complexity for advanced analysis, and the Memex for instant selection of filed records—these are only a few of the devices Bush's fertile mind has conjured together to make us realize how inefficient we are in utilizing the knowledge we laboriously acquire and speedily forget.

The heart of *Endless Horizons* is the group of six chapters from Bush's Report to the President: *Science, the Endless Frontier*. Here the plan for a National Science Foundation took shape, later to be converted into the Kilgore and Magnusson bills which battled their way to a compromise that was finally passed by the United States Senate in the session of Congress just ended. Since it was largely due to the testimony of Vannevar Bush that this bill, supported by an overwhelming majority of American scientists, met its death in committee in the House of Representatives, it is essential to understand the differences in point of view that led to so unfortunate an outcome. In "The Means to the End," Bush has outlined the organization of a National Science Foundation that would be directly controlled by a non-political board of scientists which would appoint a Director of its own choice. This Foundation would be virtually independent of the government except for original grants of funds. The bill, however, proposed a Director to be appointed by the President of the United States, with the board of scientists to act in an advisory capacity. This poses the real major issue, for the discussion weighing the merits of laissez-faire research against controlled research and teamwork seemed to reach a happy solution in a plan allowing room for both. In a democracy, however, it is questionable whether the immense power such an agency would wield should be cut loose from its source in the people and their elected representatives. Inevitably there come to mind the glowing visions of H. G. Wells' scientific Utopias, ruled by boards of scientists for the welfare of mankind, visions that enchanted our more youthful hopes. Sadly we have learned, as we grew older and wiser, that scientists, at least those we know personally, are not much different from other men and that power still corrupts. How often we have seen that the greater the responsibilities laid on a college president, on the head of a foundation, or even on the chairman of a department, and the greater the power he wields, the more arbitrary become his decisions. Only a very great and very humble man can avoid this. Is the democratic political control, with all its obvious faults, not better after all?

Bush is a fine writer who wastes no words, and who says clearly and directly what he has to say. The other essays included in the volume, particularly those dealing with the control of atomic energy and the reform of the patent system, are well worth reading.

BENTLEY GLASS

THE UNIVERSITY AT THE CROSSROADS. *Addresses and Essays.*

By Henry E. Sigerist. Henry Schuman, New York. $2.75. x + 162 pp. 1946.

Henry Sigerist presents the dilemma of the university very clearly. "Intelligent action requires educated people and knowledge that is the result of research." But, "As a result of the increase of knowledge and the necessary specialization of research, our universities have become conglomerations of schools with a great number of large departments .... The professor who is head of a department has thus become primarily an administrator, and we all know dozens of distinguished men whose research career ended the day they were appointed to some famous chair as a reward for outstanding researches .... This very development of specialized research ... which took place right in the university ... has created a new situation, and if the university takes a conservative attitude, clinging to the traditions it established from the 18th century on, ... research will be divorced from the university." "Traditionalism always was the curse of the universities." But without research, he goes on to say, the teacher, out of touch with creative work, becomes increasingly academic and sterile in thought. On the other hand, without the human touch that comes from working with students, especially young students, the research worker loses touch with life and change, and is not "forced to think his problems to the end and to formulate and present them clearly." Possible solutions of the dilemma are sketched, but no final answer is forthcoming just now. Only when Sigerist turns to his own field of medical education, and particularly to a discussion of the proper place of the study of the history, philosophy, and social relations of medicine in medical education, does it become clear from his prescription of more or less specific remedies what the general solution might be.

The glimpses one gets of Sigerist the student, teacher, and man of social responsibility, as one reads his essays, are delightful and inspiring. The essay "Classics of Medicine," like Raymond Pearl's *To Begin With*, raises the question of what a student should read to supply a broad foundation and real understanding of his subject, and the further question of how these "classics" can be made cheaply and freely available to the impecunious student. This essay, like the final essay on "The History of Science in Postwar Education," ought to be read by every biologist. If there is anyone who sees clearly the value of studying the neglected history of science, Sigerist is that one. "... I

was a very poor mathematician until I began to study the history of mathematics. Then all of a sudden things were clear, I understood them. Goethe was certainly right when he said: *Die Geschichte der Wissenschaft ist die Wissenschaft selbst.*"

BENTLEY GLASS

SCIENCE AND SCIENTISTS IN THE NETHERLANDS INDIES. *Natuurwetenschappelijk Tijdschrift voor Nederlandsch Indië. Volume 102—Special Supplement.*

Edited by Pieter Honig and Franz Verdoorn. Board for the Netherlands Indies, Surinam and Curaçao, New York City. $4.00; £1.1.0. xxiv + 491 pp.; 1 map. 1945.

The editors have assembled materials from a wide field to show the status of a number of branches of natural science in the Netherlands Indies. This material includes original articles, reprints of significant articles and pertinent selections from early writings. There is also included a list of scientific institutions, societies, and workers in the Netherlands Indies at the time of the Japanese invasion. A miscellany (Serta Malesiana) of short statements on the Netherlands Indies completes the volume. This work is published by the Government of the Netherlands Indies, but it is not a narrow nationalistic presentation. The book is most handsomely prepared with numerous illustrations, maps, and reproductions of old engravings of scientific and historical interest.

Since the work is encyclopedic in nature, it can not be reviewed in the usual way. A rough grouping of the articles by subject shows that botanical studies prevail, 25 such articles including 5 on cinchona and 3 on the Tjibodas Biological Station and Forest Reserve. Other subjects are represented as follows: geology 5, zoology 3, livestock and veterinary service 3, medicine 3, soils 2, economic geography 2, prehistory (paleontology) 2, and one each for climate and meteorology, fish and fisheries, wild life conservation, and astronomy.

In part, this representation reflects the interests of the editors. It also reflects the interest of the government in the development of the plantations, with their vegetable crops, and the history of the economic development of the Netherlands Indies. The quality of the articles is high, and their wide coverage makes this virtually a handbook on the Netherlands Indies. However, it has none of the dehydration of the usual handbook. The articles are competent and authoritative. The selections from earlier writers are highly readable. Many of the articles contain lengthy bibliographies, and the editors have supplied a lengthy list of recent bibliographies on the Netherlands East Indies.

This is, in short, a book invaluable for research libraries and, at the same time, a handsome and enjoyable addition to that of an individual.

GEORGE F. CARTER

A NATURALIST'S SCRAPBOOK.

By Thomas Barbour. Harvard University Press, Cambridge. $5.00. x + 218 pp. + 17 plates. 1946.

The late Curator of the Harvard Museum has assembled in this book a variety of observations and impressions that indeed make it a "naturalist's scrapbook," particularly with respect to such phases of natural history as have their foundations in the museums of New England. The subjects discussed are quite varied, covering such matters as the discovery and acquisition of valuable and useful materials, the personalities of naturalists known to the author, the modernization of old museums, and a great number of miscellaneous stories so diversified that their appeal will depend upon the tastes of the individual reader. The reviewer found several statements that caught his particular fancy, such as the point that the poisonous slime of the frog *Dendrobates tinctorius* will cause plucked parrots to regenerate yellow rather than green feathers, and that the king snakes of Okracoke Island, North Carolina, will eat only mice rather than other snakes (the exclusive food of this species elsewhere).

In spite of this, it is probable that this book will not be as popular as Barbour's other recent works of a similar character, for the subject matter in general seems of a sort that would require an intimate acquaintance with the museums, localities, and people involved. In addition, the organization and style are not equal to the stimulating one achieved by the author in the past.

JOHN E. CUSHING

YOU AND THE UNIVERSE: *What Science Reveals.*

By John J. O'Neill. Ives Washburn, New York. $3.50. viii + 329 pp. 1946.

The author of this book is the science editor of one of the New York dailies. The book itself is the sort of popularization of modern science that one would expect a newspaper man to write. There is little in it that is new. Most of it consists of a retelling of what has already appeared elsewhere. Much of it gains in clarity by the retelling, but some of it does not.

The reviewer is astonished by the amount of space devoted to *psychokinesis*, the theory that the throw of dice may be influenced by a process of cerebration. Just why Rhine uses such a complicated technique in the investigation of such a comparatively simple problem has never been made clear. A single die would have given a normal distribution with the possibility of making the expected number of successes equal to that of the failures, but the uses of a pair of dice, with the concomitant necessity of assuming successes and failure in the ratio of 5 to 7, adds much, and entirely unnecessary, labor to the mathematical analysis. Doubtless the inclusion of this discussion was due to an altogether admirable desire on the part of the author to

be fair to Rhine, whose bizarre theories should be given courteous treatment even by those who are prejudiced against them. We should not judge the book by its weakest chapter.

Of the two parts of the book, the first, which is much the better, is devoted to the life sciences, and the second deals with the sciences of inanimate nature. This latter half suffers from a haziness of expression that is absent from the former. One can get a better understanding of relativity from writers such as Eddington, Russell, or Bishop Barnes, than from O'Neill's efforts.

The book is provided with a topical index of eight pages.

EXPLORING IN SCIENCE. *Our World of Science.* *By Gerald S. Craig and Beatrice Davis Hurley. Illustrated by Heman Fay, Jr., Forrest Orr, Thomas W. Voter, and Jacob B. Abbott. Ginn and Company, Boston.* $1.28. 319 pp. 1946.

This is a new science textbook for the fourth grade of elementary school. It contains twelve units, of which seven deal with aspects of the physical sciences, four with biological matters, and one, on conservation, includes both. If this balance between the sciences is maintained in the other seven books of the series, as it is in the next, *Working With Science*, biologists are likely to feel that their sciences have gotten the short end of the horn. Most educators maintain that the life sciences have paramount appeal to children, and without making invidious comparisons, perhaps an even balance between physical and biological sciences might be more justifiable. It is true, however, that in many curricula special place is given in the elementary grades to the study of hygiene and safety problems, so that perhaps it was felt by the authors that the biological sciences receive due attention when all is taken into consideration.

The biological topics deal with Some Social Animals, How Other Animals Live, Gardens, Plants and Animals (that) Help Us, and Conservation (part). The style of the text is carefully adapted to the mental development of fourth grade children, but it does appear to an adult rather stereotyped and unnecessarily repetitious. The illustrations, a majority of which are in color, are most attractive—in fact, quite the feature of the book. Experiments are suggested in the text itself, thought questions are grouped at the ends of units, there is a good glossary of science words new to the child's vocabulary, and an adequate index.

BENTLEY GLASS

WORKING WITH SCIENCE. *Our World of Science.* *By Gerald S. Craig and Katherine E. Hill. Illustrated by Harold Sichel, Loretta and Prentice Phillips, and Alma Froderstrom. Ginn and Company, Boston.* $1.36. 384 pp. 1946.

Like the book just reviewed, this textbook is one of a series of new science textbooks for the elementary grades prepared under the editorship of Gerald S. Craig of Teachers College, Columbia University. *Working With Science* is for the fifth grade. It includes 15 units, of which five deal with biological subjects wholly, and a sixth in part. These are: Plants Through the Seasons; Animals Through the Seasons; Climates and Living Things; Knowing Plants; Knowing Animals; and (in part) People Are Planners. The first three of these units are closely integrated with units of physical science that deal with seasons, climates, and weather, so that the whole makes a fine ecological study. The general plan of the book, including suggested activities, a glossary, and an index, is like that of *Exploring in Science.* There is a smaller proportion of illustrations in color than in the latter book, but there is still a goodly number, and all the illustrations are very attractive and suitable.

BENTLEY GLASS

BIOLOGY LABORATORY NOTEBOOK. *By Sol M. Rudin and Peter Greenleaf. Globe Book Company, New York.* 90 cents (paper). 144 pp. 1946.

This high school laboratory manual is by all odds the best the reviewer has ever seen. Though the directions are clear and simple and stick to essentials, so that high school students should have no difficulty in using the book, the coverage of topics would do credit to any college course in general biology. The directions usually take up in order the Object, Materials, Method, Observations and Drawings, and Conclusions of the exercise. Stimulating questions are asked in the Conclusions. The 66 exercises appear to be chosen on the basis of a course emphasizing general principles rather than one that attempts to present a full survey of the plant and animal kingdoms. The great variety of topics is best shown by listing a small sample: Onion epidermal cells; cheek epithelial cells; frog dissection; frog tissues; microscopic study of a leaf; osmosis; vitamin experiment with rats; gastric digestion; circulation of blood in the goldfish; liberation of gas in photosynthesis; phototropism in the fruit fly; human reflexes; learning in rats; effect of thyroid hormone on tadpoles; Redi's experiment; yeast fermentation; vegetative propagation in plants; life history of insects; growth of pollen grains; cell division by mitosis; inheritance in sorghum; fossil formation; effect of temperature on bacteria.

The choice of exercises is excellently balanced. Observation, drawing, graphic recording of experimental data, description, and scientific experimentation are all employed frequently enough to develop skill in

their use by practice. The different fields of biology are each given appropriate place: ecology, morphology, physiology, heredity, development, behavior, evolution, classification—and knit together in a comprehensive unity. The authors' understanding of biological facts and principles is entirely adequate. One will not need to worry about errors of fact or interpretation.

The format deserves a bit of criticism. Pages are printed on one side only, but the paper is too thin and its quality too poor to permit use of the blank sides for drawings. Other space left for drawings is insufficient. Aside from this one flaw, the manual is a masterpiece of its kind.

BENTLEY GLASS

BIOLOGICAL FIELD STATIONS OF THE WORLD. *Chronica Botanica, Volume 9, Number 1.*

By Homer A. Jack. The Chronica Botanica Company, Waltham, Massachusetts; G. E. Stechert and Company, New York. $2.50 (paper). 73 pp. 1945.

It is hard to imagine any general information about the purpose, history, location, administration, equipment, living facilities, instruction provided, and research conducted at biological stations not given here. The directory of biological stations, as of 1940, lists 202 abroad and 69 in the United States. The author has visited 79 of these himself, between 1937 and 1941. The bulletin should be of value to prospective students and investigators as a guide, to administrators of biological stations for comparison, and to all those interested in the methods and facilities of biological investigation. Those who have worked at one or another of these stations and have acquired that life-long nostalgia which they breed will pore over these pages with absorption.

LIVING BIOGRAPHIES OF GREAT SCIENTISTS.

By Henry Thomas and Dana Lee Thomas. Illustrations by Gordon Ross. Blue Ribbon Books, Garden City, New York. $1.00. viii + 314 pp. + 20 plates. 1946.

The twenty brief life stories of great scientists making up this collection include Archimedes, Roger Bacon, Copernicus, Galileo, Newton, Lavoisier, Dalton, Humboldt, Faraday, Darwin, Huxley, Agassiz, Mendel, Pasteur, Kelvin, Haeckel, Steinmetz, Marie Curie, Banting, and Einstein. The sketches are rather well written, although according to a common formula which demands a note of pathos at the end. This is at first effective, but eventually gets to be a bit wearing. Human interest is stressed rather than description of real scientific achievement, and it is well that the authors have adopted this pattern, for on several occasions when they have tried to report on the scientific discoveries made by their heroes, they have failed lamentably. It is misleading, if not false, to say that Darwin worked at accumulating facts for twenty years before he framed a theory of evolution in his own mind, and not much is left of his theory of Natural Selection when one leaves the existence of hereditary variation out of it. The Mendelian principles are bungled—and so on. Yet on the whole the authors have written an interesting and stimulating book that can be recommended to young high school and college students and to the general non-scientific reader.

Only one selection in the gallery seemed puzzling. How does Haeckel, whose reputation has about reached its nadir, happen to be chosen? Whatever the answer, it must be confessed that this sketch was particularly interesting. Perhaps it was because it has so much more "human interest" than the others.

BENTLEY GLASS

ECOLOGY

DISPERSION OF SMALL ORGANISMS, *Distance Dispersion Rates of Bacteria, Spores, Seeds, Pollen, and Insects; Incidence Rates of Diseases and Injuries. The American Midland Naturalist, Volume 35, Number 1, January 1946.*

By D. O. Wolfenbarger. The University Press, Notre Dame, Indiana. $1.00 (paper). 152 pp. 1946.

The dissemination of organisms from their points of origin contributes not only one of the most fascinating chapters in the field of natural history, but furnishes also the clues (and hence the control measures) to a wide variety of economically important biological phenomena. Since the literature on the quantitative analysis of the dispersion of organisms has been so widely scattered and disorganized, there has been a real need for just such a compendium as the present type.

Into this treatise the author has gathered a monumental body of quantitative data on the dispersion of a lengthy series of objects ranging all the way from such inanimatae as water splashes and balloons, through viruses, to the spores, pollen, and seeds of the plant kingdom, and the insects of the animal kingdom. The regression lines and equations are listed for the dispersion of some 175 separate species of organisms in various stages of development, and under several physiological stresses.

In summarizing the generalizations, Wolfenbarger his indicated the remarkable consistency of repeated observations on the rate of dispersion of an organism in point of time and distance, and the surprisingly close agreement of observations made by different investigators in this interesting phase of biology. The various modes of dispersion, as well as the physiological factors influencing the individual and mass movements

of organisms, have been discussed clearly and authoritatively.

A bibliography of some 230 titles and a complete index enhance the value of the study as a reference work. The monograph will undoubtedly find a popular place in the library of every animal and plant ecologist.

B. AUBREY SCHNEIDER

WONDERS OF NATURE: *How Animals and Plants Live and Behave in Relation to Their Natural Surroundings. By R. I. Pocock and others. Illustrated by C. F. Tunnicliffe. Wm. H. Wise and Company, New York.* $2.98. 320 pp. 1945.

This is the kind of natural history book I vainly wished for as a boy. The superb and abundant photographs and drawings by Tunnicliffe are accompanied by chapters aptly described by the title and subtitle of the book. They have been written by a group of British biologists: R. I. and C. I. Pocock, L. R. Brightwell, Frances Pitt, J. S. Watson, Harold Bastin, W. Percival Westell, and Norman F. Ellison. The style is not written down to the reader. It is good popular writing, not afraid of a modicum of necessary scientific names and terms, accurate and always interesting. The first chapter briefly sketches evolution, with a bit about Mendelian heredity and the theory of natural selection. The next chapter takes up the story of the embryonic development, immaturity and training of animals. The remaining chapters cover: mammal behavior; animal and plant reproduction; war and peace in nature; the primates; plant life and structure, and wonders of plant life; birds, their habits, and remarkable things about them; the invertebrates; insects and insect life; ocean and river life; and the balance of nature. Not a page lacks a variety of interesting facts. It would be a strange person not fascinated by the book. Three adult biologists almost took it away from my young son, who had ventured out of doors with it at the summer laboratory.

BENTLEY GLASS

EXPERIMENTAL DETERMINATION OF THE INFLUENCE OF THE RED-LEGGED EARTH MITE (HALOTYDEUS DESTRUCTOR) ON A SUBTERRANEAN CLOVER PASTURE IN WESTERN AUSTRALIA. *Bulletin Number 183. By K. R. Norris. Council for Scientific and Industrial Research, Melbourne.* Gratis (paper). 36 pp. 1944.

EVOLUTION

BIBLIOGRAPHY AND INDEX OF GEOLOGY EXCLUSIVE OF NORTH AMERICA. *Volume 10—1943–1944. By John M. Nickles, Marie Siegrist, and Eleanor Tatge. Geological Society of America, New York.* $1.50. xiv + 203 pp. 1946.

This useful bibliography and index is planned in a way that biologists might well imitate. In the bibliography, approximately 2900 papers are listed alphabetically by author, in order of publication under each author. In cases of dual or multiple authorship, the authors other than the first are listed for cross reference. The title and reference are followed by a brief sentence or two indicating the nature of the contents. A sample listing, a bit longer than most, reads as follows:

Bystrow, A. P. Kotlassia prima Amalitzky: Geol. Soc. Am., B. v. 55, no. 4, p. 379–416, 22 figs., Ap. '44. "*The skeletal material of Kotlassia prima, a primitive tetrapod from the upper Permian of the north Dvina river in northern Russia, is described and figured in detail. The various specimens permit a nearly complete description except for the feet. Karpinskiosaurus secundus is a synonym of Kotlassia prima. The animal is definitely amphibian in nature although it may be regarded as a relict of the reptilian ancestors of the Reptilia. Kotlassia was as an adult a terrestrial form, in contrast to the contemporary Dvinosaurus. Seymouria may be an amphibian of the same kind.*"

The index occupies 53 pages and is exceedingly well organized. Under Amphibia, for example, we find:

Amphibia
General: Kuhn, O.
Kotlassia, Russia, Dvina river region, north, Permian: Bystrow
Sassenosaurus, Spitsbergen, Eotriassic: Nilsson 1, 2
Stegocephalian, Spitsbergen, Triassic: Nilsson 2

Kotlassia is also listed under Paleontology, *Permian*, Russia, Dvina river region, north: Bystrow; and under Russia, *Paleontology*, etc.

The question should be raised whether this is not a far better guide to the literature than such a volume as the *Annual Review of Physiology*, which, although much larger, is still too condensed to permit critical reviews, which provides a less complete coverage of the literature of the entire field, since only selected subjects are included, and which is far less admirably indexed. The difference in price and quality is the final argument, for the *Annual Review* costs $3.50 more, and the binding, paper, and printing of the *Bibliography and Index of Geology* is far superior. It is a very handsome volume.

BENTLEY GLASS

REVISION OF THE SUBORDERS, FAMILIES, AND GENERA OF THE SCLERACTINIA. *Geological Society of America Special Papers, Number 44. By Thomas Wayland Vaughan and John West Wells. Geological Society of America, New York.* $3.25 (paper). xv + 363 pp.; 51 plates. 1943.

It is a rare pleasure to review a paleontological monograph so well written, excuted, and illustrated, as this by Vaughan and Wells—a synthesis of the life work of the senior author on fossil and living stony hexacorals (the Scleractinia).

Starting with a critical review of the previous investigations on corals, the authors proceed with an excellent and profusely illustrated treatment of the morphology and anatomy of the coral polyp and its calcareous skeleton, taking good care of ontogeny in their stride, and working out in particular detail the structure and origin of coralian septa. In doing so they adapt the theory of septal evolution, originally suggested by Miss Ogilvie (1896), with a much broader scope than originally tendered, and make it fundamental to a natural coral classification.

Reproduction and the colonial habit are treated next, to be followed by the discussion of ecologic control over growth-form and distribution, growth rate, relation to other animals and plants, and the distribution of the Scleractinia in geologic time and in space. The evolution of the stock, a systematic classification supplemented with keys to the genera of each family, and classified references numbering over a thousand titles, complete the text, which is followed by 51 plates. These can hardly be excelled in their depiction of the coral growth forms and their details, and in the techniques of photographing and assembling the illustrations in plates, especially considering the fact that some figures were reproduced from varied sources.

Brevity bordering on severity, and explicitness of generic characterization that gives only the essence of what distinguishes one genus from another, yield what may be considered a modern classic in the expression of scientific thought. A few carefully selected words suffice, where most authors would indulge in long and involved descriptions, without making the attempt to separate the essential from the non-essential. The following random example typifies the style and method of presentation carried consistently throughout the "Systematic Classification."

"12. *Isophyllia* Milne Edwards and Haime 1851
Plate 39, figure 2

Pol. foss. Terr. pal., 87.

GENOTYPE (genolectotype, Matthai, 1928): *Oulophyllia ? spinosa* Milne Edwards and Haime 1849 = ? *Madrepora sinuosa* Ellis and Solander 1786 (= *Mussa dipsacea* Dana 1848). Recent. West Indies.

Colony formation by circumoral budding followed by intramural budding. Series later discontinuous, closely united laterally, with ridged or grooved collines. Centers linked by trabeculae. Epitheca rudimentary.

Recent. West Indies. Bermuda. 2 species."

M. K. ELIAS

PENNSYLVANIAN GEOLOGY OF A PART OF THE SOUTHERN APPALACHIAN COAL FIELD. *The Geological Society of America Memoir 13.*

By Harold R. Wanless. Geological Society of America, New York. $3.25. xii + 162 pp. + 17 plates, 2 maps, and 20 charts of geological sections. 1946.

This memoir is almost entirely devoted to stratigraphy. It is concluded that the Pennsylvanian (early) strata of western Virginia, southeastern Kentucky, Tennessee, and northwestern Georgia, of a maximum thickness of nearly 6000 feet, are all "sediments of aqueous deposition, and probably record piedmont, delta, marsh, lake, and shallow sea-floor environments. Marine fossils are found in only about one per cent of the strata, while fossil plant remains are much more widely distributed. This suggests that the waters in which deposition took place were fresh a large part of the time .... The source of sediment would seem to lie to the southeast in the old land Appalachia .... There is, however, some evidence suggesting the derivation of sediment from the Canadian shield to the north." One fossil cast of a tree trunk several feet high is illustrated.

STRATIGRAPHY AND PALEONTOLOGY OF THE TERTIARY FORMATIONS AT COOS BAY, OREGON. *University of Washington Publications in Geology, Volume 6, No. 2.*

By Charles E. Weaver. University of Washington Press, Seattle. Paper. Pp. 31–62 + 10 plates. 1945.

This publication follows the pattern of Weaver's *Tertiary Stratigraphy of Western Washington and Northwestern Oregon*, published in 1937 as volume 4 of the University of Washington Publications in Geology.

The type localities of the Arago formation, Bassendorf shale, Tunnel Point sandstone, and Empire formation are in the Coos Bay district. The type sections, which are exposed in sea cliffs, were meticulously measured by plane table traverses. The traverses, showing the lithology and attitude of the strata and stratigraphic position of fossil collections, and structure sections are reproduced in a series of maps on a scale of one inch to 200 feet. Columnar sections are drawn on the same scale. The base of the Arago formation and the basal part of the Bassendorf shale are not exposed. An unknown thickness of the Tunnel Point sandstone is concealed by overlap of the Empire formation, and an unknown thickness of the Empire formation lies under the waters of Coos Bay. The fossils, chiefly foraminifera for the Bassendorf shale and chiefly mollusks for the other formations, are listed. The Arago formation is assigned to the Eocene, the Bassendorf shale to the late Eocene and early Oligocene, the Tunnel Point sandstone to the Oligocene, and the Empire formation to the Pliocene, all agreeing with current age assign-

ments. The occurrence in the Empire formation of fossils that indicate an age older than Pliocene, notably the species Dall described as *Phalium turricula*, *Phalium aequisulcatum*, and *Eudolium oregonense*, is not discussed. Most of Dall's fossils were purchased from a local collector and therefore may have represented more than one formation. The three species mentioned, however, have been found in the Empire formation by both Howe and Weaver. If the Empire fauna is Pliocene, as indicated by most of the species, it includes some pre-Pliocene relicts unknown in Pliocene faunas elsewhere on the Pacific coast.

The designations "Bassendorf formation" and "Bassendorf shale," "Tunnel Point formation" and "Tunnel Point sandstone" are used interchangeably in text and illustrations. Lithologic designations are advantageous for formations consisting principally of one type of rocks. "Coaledo formation" of plates 6 and 7 is evidently an error for "Arago formation."

W. P. WOODRING

TERTIARY PRAIRIE GRASSES AND OTHER HERBS FROM THE HIGH PLAINS. *Geological Society of America Special Papers, Number 41.*

By Maxim K. Elias. The Geological Society of America, New York. $1.50 (paper). 176 pp.; 17 plates; 1 chart. 1942.

This is the first detailed study of any monocot plant group traced from its fossil antecedents to its living descendants. Among fossils the determination of monocots has been the bane of botanists, assignment to form genera usually being the only identification that could be guardedly ventured. Elias has skillfully integrated an enormous fund of data, assembled primarily from field work in the High Plains and related to a thin but widely scattered literature. The result is a work of first-rate importance. The six parts of Elias' study cover a range of topics. Enumerated tersely they include: historical introduction (Part 1), morphology (Part 2), taxonomy (Part 3), phytography (Part 4), evolution (Part 5), and stratigraphy (Part 6). Thus, from its contents, it will be evident that this work is of interest to botanists, vertebrate paleontologists, geologists, and students of evolution alike. The book is up to the usual excellence of the series in format, having been printed in clear open type with the subject matter tastefully organized. The photographic illustrations of seeds made by P. Morris of the Peabody Museum under Elias' direction are among the finest that have yet been published.

Considering the family Gramineae as a whole, with its 6000 species distributed among 500 genera, the two genera *Stipa*, with 250 species, and *Aristida*, with 320 species, do not seem of particular moment. It is the completeness of the evolutionary history that has been assembled by Elias that makes this study significant. One device that will interest students of evolution is a novel dendritic phylogeny of the sections of *Stipa* and closely related genera that is correlated with an indication of geographic distribution of each section (Table 3). Throughout the study, the impression is given that Elias has attempted to trace every single fact that might illuminate his findings, and many corollaries are drawn which are suggestive and deserve further consideration.

A reviewer is tempted to point up here and there *addendae et corrigendae* that center about fields with which he is especially familiar, but these do not often seriously mar the merit of the work as a whole. For his *Panicum elegans* Elias proposes as new an "early mutation" which he names *nebraskense*. This is "differentiated . . . because it is somewhat different in size and shape and was found in the basal part of the *Biorbia fossilia* zone, while *P. elegans* belongs to its upper half." No working definition for an "early mutation" is offered, however, and from an examination of the figures (Plate 16) it is not evident why these specimens so named should not as logically represent a distinct species just as readily as an "early mutation." It seems difficult, if not unwise, to attempt to introduce a temporal connotation into nomenclature.

A comparison of the preserved "stones" of the Lower Pliocene *Celtis willistoni* with those of the living Kansas species *C. occidentalis* leads the reviewer to question the distinctness of these two species. Indeed, the leaves may be clearly distinct but the stones are illustrated as being of critical importance. Certainly the living hackberries are a "difficult" group!

The name *Krynitzkia* is accepted in most American herbaria, says Elias, whereas *Cryptantha* is the usual generic name applied to the large West American group of borages. It would be interesting to learn Elias' criteria for deciding that *Anchusa officinalis*, among the borages, is the "probable living descendant" of the fossil *Biorbia fossilia*. Such discussions of working criteria are of enormous value to other workers confronted with similar problems in phylogeny. Section *Uniseta* was omitted from a consideration of the geographic distribution of the sections of *Aristida* and the suggested evolutionary connections (Table 1). It is difficult to follow the typification of *Oryzopsis* sections at times, as in the instance of Section *Eriocoma* (Nutt.) Elias, which is properly based on *Stipa hymenoides*. But this species of *Stipa* is not mentioned in the synopsis of the sections of *Oryzopsis* on the succeeding page (p. 72), where the name "Stipa hymenoides" is not mentioned. At times the description of the fossil grass fruits has an entomological note, as when *Berriochloa* is defended because "the want of the labrum in *Berriochloa* does not come forward and above the prow but, when preserved (which is not very often the case), it is always behind the prow. In *Berriochloa* the prow

of the palea usually reaches the level of the crown and thus occupies all frontal space between the frontal edges . . . "—or is this anthropology?

Elias creates a new genus *Clementsiella* for *Stipa laminarum* Ckll., described from Lower Miocene Florissant beds of Colorado, because the awns of the caryopsis are permanently curved, assuming that the fruits were deposited in water and fossilized in a lake bottom deposit, a treatment which would ordinarily straighten the awn of any typical *Stipa*. Two grass genera having permanently curved awns are reviewed but rejected in placing this Colorado fossil. The early Tertiary date of these Florissant fossils is also out of harmony with the view that living genera, by and large, originated "very late in Tertiary and Quaternary times." Elias cautiously says that *Clementsiella* "seemingly belongs to Gramineae."

"The articulation of the awn, so prominent in *Stipa* and absent in the most typical *Aristida*, is an ancient and not a lately acquired character, at least so far as Stipeae are concerned," says Elias. Furthermore, he points out that the anatomy of the awns permits a clear distinction between the two genera. In *Stipa*, three vascular bundles are developed in the awn. *Aristida* should be considered as derived from *Stipa*, from anatomical, morphological, and ecological evidence, he believes. Both genera were derived from the fossil genus *Stipidium*, but no material is known from the Pleistocene which may be understood to connect the Tertiary *Stipidium* with genera living today.

The detailed account of the sections of *Stipa* is of interest to the plant geographer. Noteworthy is the occurrence of a single *Stipa* species, *S. dregeana*, in South Africa; it is closely related to the palaearctic Section *Ptilagrostis*, with some points of affinity with American species of the section. Cain has reviewed the comparable Afro-American pattern demonstrated by the genus *Menodora*, and still the underlying significance is not yet clear.

JOSEPH EWAN

MEGAFAUNAL ZONES OF THE OLIGOCENE OF NORTHWESTERN WASHINGTON. *University of California Publications, Bulletin of the Department of Geological Sciences, Volume 27, Number 5.*

By J. Wyatt Durham. University of California Press, Berkeley and Los Angeles. $1.50 (paper). Pp. 101–212, incl. plates 13–18. 1944.

The Oligocene of Washington is divided into seven faunal zones based on mollusks, the oldest zone being only tentatively proposed. For the most part the sequence of zones was determined by superposition in the following three areas in northwestern Washington, which include the type localities of five of the definitely proposed zones: the Quimper Peninsula, the Blakeley area, and the Twin Rivers area. The geology of these areas is shown in sketch maps and columnar sections. The Quimper Peninsula, however, is not zonally tied to the other two areas, the inferred age relations resting on the stratigraphic relations of a probable equivalent of one of the zones (*Echinophoria rex* zone) farther south in western Washington in the type region of the next older zone (*Turritella porterensis* zone). The uppermost two zones are considered of probably Miocene age by some geologists. Fossils are listed by zones, and a consolidated list shows the zonal distribution of important species, some of which are illustrated. A catalog shows the zonal range of 301 species and subspecies, 69 of which are new.

If the faunal zones are well established, they will be of great value, because exposures of bedrock formations are not extensive in Washington. For the very reason, however, that exposures are not extensive, the zones are to be accepted with caution until the sequence and composition of the faunas is verified at additional localities, if such are to be found.

W. P. WOODRING

PLIOCENE FLORAS OF CALIFORNIA AND OREGON. *Contributions to Paleontology. Publication 553.*

Edited by Ralph W. Chaney. Carnegie Institution of Washington, Washington, D. C. $5.00 (cloth); $4.50 (paper). vii + 407 pp.; map + 64 plates. 1944.

In proportion to other divisions of Paleobotany the papers on Cenozoic arboreal floras of America are prolific. Progress in this research can be noticed in progressive changes of character and quality of illustrations of fossil leaves and other detached parts: from the crude and somewhat generalized sketches of the past, to excellent photographs, or accurate detailed drawings in contemporary publications. Progress is also evident in the method of identification, from the earlier simplified and hazardous matching, to a more reasonable, comparative analysis of structural details, accompanied by the demonstration of affinity through placing photographs of living leaves from herbaria and of fossil leaves side-by-side—a method of illustration so characteristic of Chaney's school. In one of his earlier works Chaney also introduced statistical method in establishing the correlation between the number of deciduous leaves in stream deposits next to a forest from the trees of which the leaves had come, and the number of the respective trees in the forest. His most important contribution lies, however, in developing the method of establishing the relative ages of Tertiary floras by ecologic analysis, combined with a postulated apparent migration of the forests under the impact of grand climatic changes in the course of Tertiary time.

The present series of ten papers by himself and his two associates is a fairly representative "cross-section" of the contributions of Chaney's school, with all their

virtues and a few shortcomings. Most important of the latter is the unsatisfactory treatment of taxonomic units, particularly species. It seems that a tendency to minimize the importance of differentiation between fossil and living species is intrinsic in the paleoecologic method as practised, because an advantage is thus gained in assuming that the fossil and living forms lived in the same or very nearly the same environments. There exists, however, a strong opposite tendency by paleobotanists not to extend names of living to fossil species, when the latter are represented by leaves only, even when their specific identity seems reasonably established. Hence there frequently exists the confusing situation of calling fossil and living forms by two different specific names, yet with a tacit assumption that in reality they belong to the same species. In order to remedy this situation, existing methods of identifying species of trees by their leaves must, in turn, be improved. The employment of biometric methods in finding an average length and width of fossil leaves, and the designation of the taxonomic units thus established as ecospecies (Axelrod, 1941) or "'ecological' species" (in the paper under review, p. 17) is progress in the right direction, but falls short of what is really necessary to put the species concept based on leaves on a sound scientific basis. Students of Tertiary leaves should take notice of Zalensky's law on the relationship of the size and venation of a leaf to its position on a tree, and which results in the development of sun- and shade-leaves (see Maximov's *Plant in Relation to Water*). Likewise, paleobotanists could profit by making the acquaintance of the comprehensive biometric method used in the study of leaves developed by Hanna Chechotova of Poland. She has applied this method to the European beech, and subsequently employed the method successfully in tracing the natural history of European, Mediterranean, and world beeches in space and time. The leaves of hackberry and elm are certainly as suitable for analysis and measurement of details of shape and venation as the leaves of a beech, and Chechotova's method could be applied to them. In justice to Chaney and his associates it may be added, however, that the task of differentiating species of trees on the basis of their leaves is indeed very difficult. Chaney cites Greenberg's statement that many species of white oak (to which so much space is given in the reviewed group of papers) are so closely related and hydridize so easily that the whole group must be considered extremely plastic, their speciation having just begun. Obviously in late Tertiary times they were even less differentiated than now. Yet this statement cannot possibly be applied to *all* species of white oak any more than to any other plants or animals in the world. Everywhere we see the process of "speciation" at its various stages: from its earlier, barely noticeable inceptions, to eventual clearcut differentiation. The following has been written in apparent despair, though not without a humorous touch: "The paleobotanist . . . when he attempts to assign his oak specimens to well defined species . . . must . . . postpone a complete understanding of their relationships until larger collections of fossil specimens have been compared with greater numbers of modern leaves from wider areas and varying habitats. *Even then the paleobotanist may have to await,* with the botanist, *the slow passage of time until the extinction of intermediate living forms* shall have resulted in separation of the white oaks into taxonomic units, which can be readily distinguished on the basis of their leaves and other characters." Again, "*If at some future time extinction shall have reduced both the number of its species and the extent of their distribution, we may anticipate that the surviving homogenic oaks will present fewer problems to the paleobotanists.*" (p. 14, italics by the reviewer). Not really! The reviewer dares a more optimistic outlook on the outcome of the race between our progress in the disentanglement of the troublesome taxonomy of white oaks, and gradual dying out of the intermediate forms to be expected.

M. K. ELIAS

GLACIAL MAP OF NORTH AMERICA. *Part 1. Map: Western half and Eastern Half. Part 2. Bibliography and Explanatory Notes. Geological Society of America Special Papers Number 60.*

By Richard Foster Flint. The Geological Society of America, New York. $2.00. Part 1. 79 inches by 52 inches, on 2 sheets. Scale 1: 4,555,000, approximately 1 inch to 72 miles. Part 2. viii + 37 pp. 1945.

This remarkably fine example of cartography will prove useful to all biologists who are concerned with the Ice Ages of the Pleistocene and their effects in North America. The accompanying booklet gives the history of the map, discusses the base map and the conventions used, and lists 31 pages of references used in making the map.

GIANT EARLY MAN FROM JAVA AND SOUTH CHINA. *Anthropological Papers of The American Museum of Natural History. Volume 40: Part 1.*

By Franz Weidenreich. The American Museum of Natural History, New York. $2.00 (paper). 134 pp. + 12 plates and 1 table. 1945.

In the last two decades the story of early man in Asia has unfolded with a hitherto unexpected speed and detail. The *Sinanthropus* finds in China, further *Pithecanthropus* finds in Java, and the *soloensis* finds in Java have all contributed to an elucidation of interrelationships and a preliminary understanding of phylogenetic continuity. In all this the names of Dubois, Black, von Koenigswald, and Weidenreich figure prominently. In this article Weidenreich brings

us up to date, especially with references to an amazing tendency to gigantism in human ancestry.

The *Pithecanthropus* series is now represented by material from Kedung-Brubus, Trinil, and Sangiran, all in Java. From the first site, in 1890, came a mandibular fragment; from the second site, in 1891–1900, came a right M^2, a skull cap, a left femur, a left M^2, a left Pm_1, and five femoral fragments; from the third site, in 1937–1941, came three mandibles ('37, '39, '41), a skull cap ('38), a skull fragment ('38), and a skull cap and maxilla ('39). The first two sites were excavated by Dubois, the third by von Koenigswald. To this last must be added the child's cranial vault found at Modjokerto in 1935.

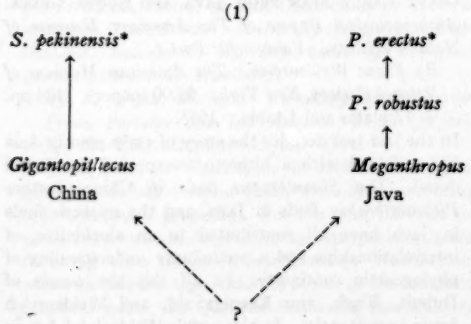
To the foregoing, and to the *Sinanthropus* population, must be added the three *Gigantopithecus* molars recovered by von Koenigswald in the 1930's from Chinese apothecary shops in Canton, a right M_3, a left M_3, and a right upper molar ($M^{1?}$). It is these teeth—Weidenreich retains *Gigantopithecus* (v.K.), though he insists that they should be called *Gigantanthropus*—that have focussed attention upon early hominid gigantism.

Human and primate paleontologists have long been aware of a tendency to large size: *Paedopithex rhenanus*, a fossil gibbon of the Lower Pliocene, *Dryopithecus giganteus*, the Heidelberg mandible, the Rhodesian, Solo, and Wadjak skulls, all show signs of "primitive" massivity. But they were all more or less isolated examples of extreme size or bulk.

In the recent *Pithecanthropus* finds a size factor is evident. The 1939 skull cap and maxilla, that of a male, is classified as *Pithecanthropus robustus* (W.), and is known as Skull IV. The 1941 mandible is classified as *Meganthropus paleojavanicus* (v.K.). These two forms are an apparent size link with *Gigantopithecus*, in a size sequence (biggest to smallest) as follows: *M. paleojavanicus* ('41 mandible) → *P. robustus* (Skull IV) → Mandible B ('37 mandible) → *P. erectus* (Skulls I, II, III) → Mandible A (mandibular fragment from Kedung Brubus).

Weidenreich compares these finds in precise morphological detail and suggests two possible schemes of phylogenetic relationship (pp. 117, 124) as follows:

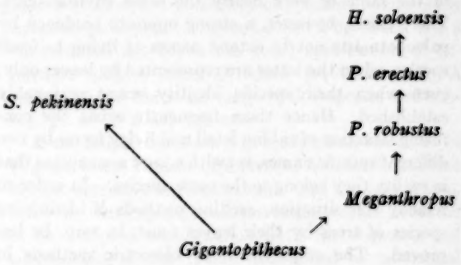
(1)



Here the two forms marked (*) are at the same stage of evolution.

In the second scheme Weidenreich suggests *Gigantopithecus* as a possible common ancestor to *Pithecanthropus* and *Sinanthropus*, both of whom are at the same stage of evolution.

(2)



In these sequences (which I have constructed from the report), Weidenreich accepts the general principle that "gigantism is a primitive character which has the tendency to diminish as evolution advances" (p. 124). He concludes that "the new finds do not offer a new clue to the special anthropoid form from which the hominids were derived" (p. 124).

The discussion of early hominid gigantism naturally arouses speculation as to actual size. Weidenreich says of *Gigantopithecus* and *Meganthropus* "that they must have had large, heavy, and massive skulls, large strong trunks, but only slightly longer and stronger leg bones. No more precise statement can be made" (p. 111).

Weidenreich touches upon the problem of the Trinil femur (1890). While admitting that it is not impossible for the femur to belong to *Pithecanthropus erectus*, he prefers to assign it to *H. soloensis* or even to *H. sapiens* (pp. 102–3). The three teeth found with *P. erectus* I are assigned to Orang-utan (the two molars) and modern *H. sapiens* (the premolar) (p. 103).

This report, as is true of all of Weidenreich's reports, is a model of precise detail. Weidenreich draws upon his tremendous store of osteology and odontology, both anthropoid and hominid, for a wealth of comparative analyses. His discussion is sound and his conclusions carefully drawn.

The problem of nomenclature rises to plague both writer and reader on several occasions. When Weidenreich discusses Skull IV he concludes that it must be called *Pithecanthropus robustus*. He goes on to say that *P. erectus* and *P. robustus* are closely related and that he does not wish the "change of name [to be] interpreted in a strictly taxonomic sense" (p. 33). Later, he accepts von Koenigswald's name of *Meganthropus paleojavanicus* for the 1941 mandible. Of this situation he says: "Nor do I consider *Pithecanthropus* and *Meganthropus* as two 'generically' different and independent hominid types in the taxonomic sense"

(p. 55). To those of us brought up on the binomial system of classification it seems inconsistent to use a terminology that apparently assumes generic and/or specific differences when in fact morphology does not substantiate this implied difference. I bring this point to focus here more because I wish all biologists to understand Weidenreich's use of nomenclature than because I disagree with his fundamental postulates in the *Gigantopithecus-Pithecanthropus-Sinanthropus* relationship. The problem of terminology is relatively unimportant in this major contribution to our knowledge of hominid evolution.

W. M. KROGMAN

EVOLUTION: THE QUANTITATIVE PRINCIPLES OF PROGRESS *And What They Mean Today.*

By A. A. Williamson. The Hobson Book Press, New York. $3.50. xvi + 270 pp. 1946.

Had the reviewer the ability to write such a book as this, he would devote his talents to a more worthy cause. The author appears to have been influenced largely by the writings of two men—Julian Huxley and Paul the Apostle, with each of whom he completely disagrees, losing no opportunity to criticise them both with more than moderate violence.

The work divides itself rather naturally into two parts, the first of which deals with organic evolution. We are told that the world of organic life is distributed over three levels. The lowest of these is the vegetable kingdom, the members of which manufacture their food from raw mineral sources. The middle level is that of the herbivores, who subsist on vegetables. The highest is that of the carnivores, who subsist on the herbivores. For obvious reasons these three levels appeared in the course of evolution in just this order. No form of life could have perpetuated itself until the food upon which it was to subsist had been prepared.

The economic position of each carnivore may be likened to the apex of a pyramid, since each one is dependent upon a large number of herbivores, each of which in turn is dependent upon a still larger number of vegetables. But in order to apply this comparison to the entire world of life it is necessary to postulate a truncated pyramid, so as to afford space at the summit for all extant carnivores. In other words, the goal of organic evolution has not yet been reached. The pyramid will remain imperfect until one carnivore has exterminated all the others.

This pyramid is also an adumbration of the processes of political and spiritual evolution, as these are developed in the latter half of the book. The three levels of the political world are the unlimited monarchy, the limited monarchy, and the republic. The three corresponding spiritual levels are those of magic, religion, and democracy.

The path of organic evolution intersects that of spiritual evolution, but so far man is the only organism which has arrived at the junction of the two. While the organic evolution of the lower forms of life still continues, that of man has ceased, because when he reached the cross-roads he changed his course, and henceforth his evolution must be mental instead of physical. Modern man should therefore be called *Homo sapiens cruciferus* — because he has passed the cross-roads. The etymology of this trinomial seems as faulty as the logic behind it.

The complexity of the structure which the author proceeds to erect upon this insecure foundation is amazing. Germany and Japan, so he tells us, are living at the level of magic. The fact that they are the toy-makers of the world proves that. China and Russia are given as examples of nations whose culture is on the level of religion—a selection that would no doubt make Comrade Stalin elevate his shaggy brows. The English-speaking nations, so the author tells us, typify the democratic level, at which an ecdysis of all religious belief is to occur, and mankind is to learn that the only object of rational worship is mankind himself. To the reviewer this appears to be the crudest kind of Shintoism, a religious belief that so far has flourished only in a nation which the author has relegated to the level of magic.

The reservation of the apex of the pyramid for the English-speaking nations is reminiscent of a nineteenth century writer who claimed for his own nation a place in the sun. Perhaps if a large enough number of people were to read this book it might accomplish for the United States what Treitschke's did for Germany. But no, the book will probably be forgotten before this review can appear in print.

There is no end to the bizarre notions advanced in this book, but why recount any more? Could the author have written it with his tongue in his cheek?

GENETICS AND CYTOLOGY

ANIMAL CYTOLOGY AND EVOLUTION.

By M. J. D. White. Cambridge, at the University Press; The Macmillan Company, New York. $7.50. viii + 375 pp. 1945.

M. J. D. White's new book is most welcome, for it nicely satisfies a pressing need in cytology. Since the last edition of E. B. Wilson's *Cell*, now twenty or more years behind the times, no comprehensive and authoritative work has appeared which brings the subject matter of cytology up to date. Instead, there have been only textbooks, monographs on particular aspects of cellular biology, or extensive treatments of selected material most often chosen largely from the botanical literature. As it now seems that there will be no successor to attain Wilson's sweeping mastery of the subject, the modern summary treatment of cytology must

lie in a collection of books by specialists representing overlapping disciplines. To this collection of elite works may now be added *Animal Cytology and Evolution*, for White has expertly encompassed in this book much valuable material that has been only superficially, if at all, touched upon elsewhere. Here is to be found an up-to-date and nearly exhaustive account of chromosome behavior in animal forms having anomalous mitoses or meioses, or bizarre life histories correlated with aberrant chromosome behavior. Here is the first extensive analysis of the morphological and functional modifications that animal chromosomes and sets of chromosomes have undergone in many groups in making for, or more probably in consolidating, evolutionary change. And here, for the first time, is a work whose purpose is the establishment of Evolutionary Cytology as a discipline in its own right, comparable with other specialized phases of modern cytology such as cytogenetics, radiation cytology, cytochemistry, and so on.

In this book there are taken up, *ad seriatim*, the nature of the evolutionary process, the structure of mitotic chromosomes, salivary-gland chromosomes, the mechanisms of structural rearrangements, meiosis, chromosomal evolution in wild populations (two chapters), the evolution of chromosome numbers and form, the evolution of meiosis and chromosome cycles, hybridization and the causes of hybrid sterility, the evolution of the sex-determining mechanism, sex-determination by male haploidy, the evolution of parthenogenesis and, in the concluding chapter, cytology and evolutionary patterns. In certain instances (e.g., the chapters on chromosome structure and meiosis) the discussions are adequate only for the purposes of the present book, but in most cases White has brought together from animal cytology the great majority of facts and ideas relevant to his topic, and his treatment leaves little to be desired. The bibliography is remarkably thorough so far as recent research is concerned, and it is to be noted how the author must have labored through the war's early years to assemble the wealth of information encompassed in this book, for this was a time when reference works and periodicals were accessible only under the most trying of circumstances.

Now White's object in presenting the enormous number of cases which he analyses is "to discuss the bearing of animal cytology upon the problem of the mechanism and process of evolution." But in so doing he unfortunately confines his attention to a consideration of chromosomes only, and few will agree with him that the evolution of cytoplasmic constituents of the cell is an entirely different subject. Indeed, the failure to include a comprehensive treatment of mitotic mechanisms, including spindle types and structures, centrioles, and so forth, leads to a feeling that not a few of the chromosome problems posed or discussed in this book are too abstract, oversimplified, or unreal to secure a satisfactory interpretation of cellular mechanisms in evolution. Furthermore, while White makes it abundantly clear what sorts of changes chromosomes undergo in evolution, it is hard to see that he contributes materially to the larger problem of the mechanisms of evolution. The broad general discussions of evolution seem weak and even commonplace, being far below the high level of White's well thought-out comparative karyology. The analyses of the specific results of evolution and the evolutionary pathways in restricted groups is another matter, for these discussions are stimulating and very helpful in gaining an orientation in the interpretatioh of cytological facts from the evolutionary point of view.

Animal Cytology and Evolution, in short, is to be highly recommended for the excellent survey it presents and for the abundant and original thought it contains on the results of evolution from the cytologist's viewpoint. Most biologists will gain much new information and stimulation from reading it. But the biggest reward is for the geneticist—botanical or zoological, who will find here much of fundamental importance for his thinking. White's book makes it only too evident that the relatively simple cytogenetic theories, currently based almost wholly on *Drosophila* and *Zea*, are inadequate in the light of today's information.

KENNETH W. COOPER

THE EARLY HISTORY OF THE IDEA OF THE INHERITANCE OF ACQUIRED CHARACTERS AND OF PANGENESIS. *Transactions of the American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge. New Series—Volume XXXV, Part II.*

By Conway Zirkle. The American Philosophical Society, Philadelphia. $1.25 (paper). Pp. 91–151. 1946.

Years of persistent search must have gone into the preparation of this work, and all biologists who are interested in the history of ideas will feel deeply indebted to the author who has provided so rich and varied a collection of source materials. The method of presenting these is simple and direct. First the references to beliefs and arguments concerning the inheritance of acquired characters are presented chronologically, brief introductory notes by the author providing a setting for the extensive quotations. Because of the close relation between the ideas of pangenesis and the inheritance of acquired characters, many of these source materials relate to both equally. The second section of the work, presenting the beliefs concerning pangenesis, consequently makes frequent reference to Part One in order to avoid repetition. Although older sources, from the beginning of written records through the thirteenth, fourteenth, and fifteenth centuries, receive considerable attention, the real richness of material lies in the sixteenth, seventeenth, and

eighteenth century records assembled. The story is closed with the briefest of discussions of the further development of the two related ideas up to the time of Charles Darwin.

As the entire work is rendered in English, much of the material has undergone translation. The accuracy of translation is therefore a matter of no inconsiderable importance. The author expresses his indebtedness for the task of translating most of the quoted passages to three collaborators. Time has not permitted a careful check of even a small sample of the translations, but they do not appear to be distinguished, and at least those passages quoted from the works of Pierre Louis de Maupertuis, with which the reviewer happens to be familiar from recent close study, are translated very badly indeed, so that in one instance the very opposite sense is given to the great Frenchman's words. It seems a great pity that in so significant a survey of the sources of biological ideas, the author should have had to rely upon others for faithful rendition of the sources.

In several respects the author does not appear to have been sufficiently critical. More than once, he appears to have mistaken a reference by one author to some earlier source as necessarily an endorsement of the quoted point of view. For example, although Vesalius is quoted in a passage of some length in which he refers to Hippocrates' famous description of the compression of the heads of the Macrocephali, a character supposed to have in time become hereditary, it is obvious that this story was hearsay; and it is not at all clear, from Vesalius' further comments on the deformation of the heads of infants in contemporary times, that he really believed in the inheritance of acquired characteristics. Yet Zirkle remarks that Vesalius endorsed the Hippocratic myth, and, along with numbers of others who repeated the story through the centuries, Vesalius is listed in the final summary as one of the definite proponents of the inheritance of acquired characteristics. This type of error reaches its extreme in the presentation of the views of the eighteenth century scientists on pangenesis, for here the passages selected to give the views of both Réaumur and Diderot happen to be passages in which those authors were presenting for consideration the ideas advocated by Maupertuis, and, at least in the case of Diderot, the passage quoted is followed by a rebuttal of some of them, although not specifically of pangenesis. Perhaps Diderot accepted this idea, but at any rate this passage cannot be taken as sufficient evidence. Sadly, one is forced to the conclusion that the selection of isolated passages is not a safe method of historical research and that a profound and laborious study of a man's entire works forms the only sound basis for arriving at his opinions. Maupertuis, for example, was not one who "definitely rejected preformationism in favor of pangenesis." His whole endeavor was to demonstrate, logically and by experiment and observation, that preformationism must give way to *epigenesis*, a very different thing than pangenesis; and he advanced the idea of pangenesis as an altogether secondary and non-essential hypothesis, with remarkable scientific caution, considering the views of his day.

There is another failure to make a distinction that is of far broader significance to this study. Zirkle rightly remarks upon the differences between the views of Buffon and those of Darwin, whose hypothesis alone should in strictness be called "pangenesis," since he coined that term. In latitude, however, Buffon's theory of organic molecules collected in the reproductive fluids from all parts of the body, and specific to those parts of the body from which they came, may also be regarded as a form of pangenesis. It is stretching the idea altogether beyond bounds, on the other hand, to regard as pangenetic the simple view that the semen is derived from all parts of the body. That Hippocratic idea was elaborated by Aristotle, who taught that the semen comes from the excess nourishment of the blood supplied to all parts of the body; and no one, as Zirkle recognizes, more emphatically rejected pangenesis than Aristotle. The sequal of this failure to make a distinction invalidates most of Zirkle's conclusions about the supporters of pangenesis; for any number of them—see, for one, the quoted passage from Cardan—were merely repeating the accepted Aristotelian doctrine of the origin of the semen.

These are grave faults. Nevertheless, the collection of these sources on two of the most interesting of biological ideas has been of great interest and value to me personally. I believe they will be of equal worth to others.

BENTLEY GLASS

GENERAL AND SYSTEMATIC BOTANY

PRÉCIS DE MYCOLOGIE. *Mycologie générale, mycologie médicale. Collection des précis médicaux.* *By M. Langeron. Masson & Cie., Paris.* 450 fr. (boards); 350 fr. (paper). 676 pp. 1945.

Now that contacts are being slowly re-established, it begins to appear that the isolation enforced on French science by the war years were not wholly unproductive, some scientists having used this bleak period to good advantage in producing works of analysis and reflection. The most outstanding example in the microbiological field is, of course, André Lwoff's brilliant and provocative monograph, *L'évolution physiologique, étude des pertes de fonctions chez les microorganismes*, a book which is surely one of the most important contemporary contributions to general biology, as well as a masterly if somber exposition of materialist philosophy in the tradition of Lucretius and Diderot.

Another work, marked by similar lucidity and theoretical insight, is Langeron's *Précis de Mycologie*, whose resemblance to any other mycological textbook ceases with the title. Langeron has succeeded in doing what was last achieved by de Bary in 1884, namely, in writing a treatise on the biology of the fungi. Systematic mycology is relegated to a short terminal chapter of 32 pages, a bare synopsis of the major groups, and the remainder of the book is largely devoted to a general treatment of such subjects as thallus structure, cytoplasmic streaming, hyphal anastomoses, organs of reproduction and propagation, mechanisms of spore liberation and dispersal, and sexuality. It will suffice to explain the approach adopted if one remarks that Langeron is a Bulleran mycologist, more interested in the dynamics than in the statics of the subject. Under his pen the fungi really come to life. Buller's work is heavily drawn on throughout, and for anyone not the happy possessor of that great biologist's *Researches on Fungi*, the present book will provide a useful synopsis and integration of his discoveries.

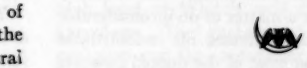
The opening chapter, entitled "Champignons et Protistes," is a lively and entertaining disquisition on the nature and origin of the fungi. Unlike so many algologists, mycologists, and protozoologists, Langeron does not suffer from an obsessive neurosis about the dichotomy between the plant and animal kingdoms, and we are mercifully spared those arguments over whether a given group belongs to one kingdom or the other. Langeron realizes the futility of trying to squeeze microorganisms into the two Linnaean categories, and adopts Haeckel's concept of the Protista, treating the fungi as a protistan assemblage. Again drawing on Buller's work, he lays great stress on the *continuity* and *mobility* of cytoplasm in fungi, structural features pithily summarized as follows: "un champignon nous apparait donc essentiellement comme une masse cytoplasmique nucléée, mobile dans un système de tubes."

Since the book appears in Masson's Collection des Précis Médicaux, there is also a long chapter on medical mycology, written from a very critical standpoint. Langeron's opinion of the contemporary state of this field is implied by the very chapter title ("A quoi se ramène la mycologie médicale?"), as well as by the barbed quotation from Faust inserted after it:

> ". . . . Denn eben wo Begriffe fehlen
> Da stellt ein Wort zur rechten Zeit sich ein,
> Mit Worten lässt sich trefflich streiten,
> Mit Worten ein System bereiten . . . ."

At the end of the book it is stated that in the face of material difficulties several chapters had to be omitted, viz., those dealing with cytology, substances elaborated by fungal cytoplasm, nomenclature, and the species concept. This loss is deeply to be regretted, and one may hope that a new edition with the excised material reincorporated will soon appear. In my opinion, the widespread use of this text in North American universities would make mycology a far more interesting and attractive subject than it commonly appears today. Is it too much to hope that some altruistic soul will undertake an English translation?

R. Y. STANIER



KEYS TO THE COMMON FLESHY FUNGI.

By Clyde M. Christensen. Burgess Publishing Company, Minneapolis. $1.50 (paper). i + 45 pp. 1946.

The present work is a series of keys which have been used by students and collectors of fleshy fungi, primarily in Minnesota, for over a decade. It is intended for beginners, amateurs, and professionals who wish to identify the common fleshy types usually encountered. Throughout the manual there has been an attempt to avoid the use of technical terms wherever possible. Since no recourse is made to microscopical characters, found in modern investigations to be of considerable importance in any critical determination of species, the author admits sacrificing a certain amount of technical accuracy, but he justifies this by the ". . . . . increased useability of the keys in the field."

Following the Introduction there is a simply and effectively worded section on how to use the keys, followed by another on Edible and Poisonous Mushrooms. The latter contains these sound words of wisdom to the would-be mycophagist: "No sensible person would think of going out into the woods and eating any and all berries he came across and neither should any sensible person eat wild mushrooms indiscriminately."

Eight plates of large-scale line drawings, obviously semi-diagrammatic, illustrate structural features. In addition the key to the genera of gill fungi carries illustrations of diagnostic significance. Following the keys, which occupy 30 pages, nineteen references to general books of value in the determination of fleshy fungi are listed. Lastly, there is a glossary of 60 terms.

Several features of this book are puzzling. If, as stated, it is intended as well for beginning amateurs as for professionals, some sort of general guide or key which would assist the novice in placing his fungus in the proper category of the fungi (Ascomycetes or Basidiomycetes) would seem to be essential. As it now stands, the neophyte is confronted bluntly, after the general introductory material, with "White Spored Mushrooms." Another and even more puzzling feature is the complete omission, without any explanation of certain common and, in some instances, large groups of fleshy fungi. Most striking of these are *Boletus*, *Clavaria*, *Thelephora*, and *Hydnum* (the last-named, although figured, being labelled "no species described"). References to standard works on certain

of the omitted groups are, however, to be found in the Bibliography.

In spite of these defects the manual will no doubt prove useful to those interested in attaining a general knowledge of some (though not of all) of the common fleshy fungi.

F. K. SPARROW

OUR TREES: *How to Know Them. With a Guide to Their Recognition at Any Season of the Year and Notes on Their Characteristics, Distribution, and Culture. Fifth Edition.*

By Arthur I. Emerson and Clarence M. Weed. J. B. Lippincott Company, Philadelphia and London. $3.00. xxii + 295 pp. 1936. *Reprint Edition, Garden City Publishing Company, Garden City, New York,* $1.98. 1946.

This well-known finely illustrated guide to our common trees has been reprinted in the original format at a reduced price. The half-tones show signs of age, and there ought certainly to be a replacement of a number of worn plates. Defects of this nature appeared to be worse in a copy obtained from the original publishers than they were in the reprint edition. The latter is a fair bargain.

ESQUISSE DE MES VOYAGES AU BRÉSIL ET PARAGUAY *considérés principalement sous le rapport de la botanique. Chronica Botanica, Volume 10, Number 1.*

By Auguste de Saint-Hilaire, with an introductory essay by Anna E. Jenkins. The Chronica Botanica Company, Waltham, Massachusetts; G. E. Stechert and Company, New York. $2.00 (paper). iv + 62 pp. 1946.

Auguste de Saint-Hilaire was a French botanist, born in 1779 at Orléans. He began his scientific career in entomology, but soon changed his interests to the botanical field, apparently influenced greatly by the work of Dubois on the flora of the vicinity of Orléans. Later, in Paris, his lifework became clear under the inspiration of such men as de Jussieu, Richard, Desfontaines, and Kunth. He concerned himself especially, in these early years, with variations and relationships among the pistils of the flowering plants, and published several notable papers on the subject. In 1816, on an official mission in the company of the French ambassador to Brazil, he sailed for South America. During the ensuing six years he traveled widely in Brazil and Paraguay, making monumental collections of their flora and fauna, and notes on their people and customs. Failing in health, he returned to France in 1822, taking up his residence at Montpellier. There he regained his strength, and spent most of the later years of his life preparing descriptions of his travels and collections, and his last great work on *Leçons de Botanique, comprenant principalement la Morphologie végétale, la Terminologie, la Botanique comparée, et l'Examen de la Valeur des Caractères dans les diverses Familles naturelles.* He died at Turpinière in 1853.

The present volume contains a reprinting of the sketch of Saint-Hilaire's travels which appears as an introduction to his volume on the *Histoire des plantes les plus remarquables du Brésil.* This was a quarto published in Paris in 1824. The *Esquisse* is a running account of the author's experiences with people and events during the six years he was in South America, with notes on his collecting activities. It is charmingly written, and gives abundant evidence of Saint-Hilaire's genuine love and admiration for the countries he visited.

From a technical standpoint the republication in Chronica Botanica is especially valuable for the well-documented and informative essay by Anna E. Jenkins which precedes the *Esquisse.* Two biographical notices on Saint-Hilaire's life, by J. J. Bennett and J. E. Planchon, are reprinted in full, as well as notes published by Urban in Martius' *Flora brasiliensis.* Likewise Dreuzy's dedicatory preface to his publication of Saint-Hilaire's *Voyage à Rio Grande do Sul* is reprinted. A map showing the itineraries is included, with a chronological list of the places visited and the time spent in each. Anna Jenkins' essay concludes with some further quotations of biographical interest, from both the publications and correspondence of Saint-Hilaire.

HUGH M. RAUP

PLANT PHYSIOLOGY

LA RESISTENZA DELLE PIANTE ALLE MALATTIE.

By Elio Baldacci. Società Anonima Editrice Dante Alighieri (Albrighi, Segati e C.), Genova, Roma, Napoli, and Città di Castello. L. 80 (paper). 263 pp. 1942.

Contents: Part I. Immunological hypotheses: Chemotropic hypothesis. Hypothesis of the acidity of cell saps. Plant Antibodies. Part II. Known factors of resistance: Defense reactions during the phase of penetration of the parasite. Defense reactions during the course of infection. Defense reactions in virus diseases. Part III. Modifications of resistance: Nutritional, by preceding diseases, by graft, by environmental factors.

There is a bibliography of 740 references, without titles.

ECONOMIC BOTANY

PLINY: NATURAL HISTORY. *With an English Translation, in Ten Volumes. Volume IV, Libri XII–XVI. Loeb Classical Library.*

Translated by H. Rackham. Harvard University Press, Cambridge; William Heinemann, London. 10s. net (cloth), 12s.6d. (leather); $2.50 (American cloth), $3.50 (leather). vii + 556 pp. 1945.

Books XII to XVI of the famous *Natural History* of ancient times deal with the trees and shrubs known or fabled. The accounts are so very interesting that it has taken the reviewer a long time to follow up the countless interesting leads that arise. Book XII deals chiefly with exotic trees, and in particular with those from which spices, gums, and incense were obtained. Book XIII describes the sources of vegetable perfumes, the palm, date, fig, and other trees supplying edibles, Egyptian trees and shrubs, including papyrus and "wool-trees" (tree-cottons), and marine vegetation. Book XIV is entirely devoted to the vine and to wine- and beer-making. Book XV takes up the olive, cultivated fruit and nut trees, and the myrtle. Book XVI is devoted to the forest trees that provide timber and other useful products—bamboo, palm-leaves, reeds and rushes, rope, etc.

The reputation of the great Roman naturalist has suffered because of his evident lack of scientific caution and his inability to distinguish fact from fancy. It is true enough that, in these books, the information about the geographical sources of plants and plant products is mostly wrong. Countries on the limits of the Roman Empire get credit for the plants and products that came from far beyond, and often the ultimate source is unknown or traced in quite the wrong direction. Nevertheless, if these accounts are taken for what they are, a digest of the scientific knowledge of the time in the field of economic botany, it will be realized how full of interest and value they are. Where Pliny speaks of prices and uses and other matters of first-hand knowledge, his evidence is of quite a different order of merit than in his relations of matters received at second-hand. The end of the matter will assuredly be a greatly heightened respect on the part of the reader for the scientific knowledge of the Romans. It is particularly in a field, such as this one, of practical applications that it shows up to greatest advantage.

The translator, whose death before this volume had been finally revised in proof we must deeply regret, has provided an excellent translation that, while it lacks the terseness of the Latin, is free in style and clear in meaning. The book lacks the detailed biological notes and identifications of plants that only a botanist with the erudition of a D'Arcy Thompson, if such there be, could have provided. Lacking that, we thank the translator for a version which any botanist may now use for fruitful studies in the history of his subject.

BENTLEY GLASS

AN INTRODUCTION TO INDUSTRIAL MYCOLOGY. *Third Edition.*

By George Smith; foreword by Harold Raistrick. Edward Arnold & Company, London; Longmans, Green & Company, New York. $5.50. xiv + 271 pp. 1946.

As expressed in the preface of this book, now in its third edition, its purpose is to assist those interested in a study of "moulds" from an industrial standpoint in learning something of this diverse group of plants. It is especially aimed at persons who are primarily chemists, with little or no training in botany and no knowledge of mycological terminology or technique, who are confronted with problems involving fungi.

Following a short foreword by Harold Raistrick, of the London School of Hygiene and Tropical Medicine, who points out the value of such a book as this to one faced for the first time with an industrial problem concerning molds, and after short prefaces to the first and present editions, one comes to an introductory chapter. Here are discussed in simple non-technical language the significance of fungi in the organic world and something of their relationships to the rest of the Thallophyta and the Plant Kingdom as a whole. There then follows a brief discussion of the general morphology and classification of the fungi. This, like all subsequent chapters, concludes with a short list of references pertinent to the topics included.

A short chapter of three and one-half pages, taking up the terminology and methods of classification utilized generally throughout biology, with mycological examples, is followed by the main part of the volume. This consists of seven chapters which deal with the Zygomycetes, Ascomycetes, Yeasts and related fungi, Fungi Imperfecti, Hyphomycetes, *Aspergillus*, and *Penicillium* and related genera. In discussing each of these groups approximately the same outline is followed. First, the essential features of each group, including any special terminology employed, are described, after which there is given an outline classification which may, as in the Mucorales, extend to genera of industrial significance. Important species are discussed and described in detail, and in many instances illustrated by photomicrographs. Throughout, references to more comprehensive treatments and to monographs of the fungi under consideration are included.

There follow chapters on laboratory equipment and methods commonly used in mycological procedures, the physiology of mold fungi, the proper methods of maintaining culture collections, the control of fungous deterioration of industrial materials, and a brief account of the industrial uses of fungi. The last chapter deals with mycological literature and consists of a list of important reference works and monographs of pertinent groups of fungi, together with comments

on their scope and value to the industrial mycologist. A list of periodicals that are primarily mycological or include mycological papers completes this section. The book closes with a ten and one-half page double-columned index.

For what it purports to be—a book for the scientific person not trained in mycology but wishing to know something of molds of industrial importance—this book is adequate. The abundance of excellent photomicrographs will unquestionably add much to its usefulness to the novice. When, however, the vast amount of information on industrial mycology and fungous deterioration accumulated during the war years is made available, this and other similar texts will stand in need of thorough revision.

F. K. SPARROW

GENERAL AND SYSTEMATIC ZOOLOGY

TAXONOMIC KEYS *to the Common Animals of Minnesota Exclusive of the Parasitic Worms, Insects and Birds. Revised.*

By Samuel Eddy and A. C. Hodson. Burgess Publishing Company, Minneapolis. $1.75 (paper). i + 114 pp. 1945.

This is a commendable effort to provide college students of zoology with a means of identification or near-identification of common animals. The authors have wisely refrained from going into detail with difficult or poorly known groups of invertebrates. The result is, however, a somewhat uneven treatment, in that some groups, especially the larger forms, are well covered whereas others are dismissed briefly. The groups with which the reviewer is most familiar, the turbellarians and aquatic oligochaetes, are poorly done and the former largely inaccurate. Over 500 simple line illustrations should add greatly to the usefulness of the book, which no doubt is applicable to the general north-central region as well as to Minnesota. The ring binding adds to the convenience. However, the reviewer is opposed to student identification of animals to species and feels that instead something should be taught of the difficulties of identification. Students should be made to identify one difficult animal to species by the same procedure followed by a taxonomic specialist. This might teach them to stop expecting any zoologist to be able to give them offhand the scientific name of an animal and to be wary of handbooks and keys that offer easy but generally incorrect identification by comparison with pictures.

L. H. HYMAN

ECHIUROID WORMS OF THE NORTH PACIFIC OCEAN. *Number 3198. Proceedings of the United States National Museum, Volume 96.*

By Walter Kenrick Fisher. Smithsonian Institution, United States National Museum, Washington, D. C. Free upon request (paper). Pp. 215–292; + plates 20–37. 1946.

This is a scholarly work on a small group of animals that is now generally regarded as constituting an independent phylum Echiuroidea. Although primarily taxonomic, the article contains much anatomical information and is generously illustrated with plates and text figures. Work of this type is a genuine contribution to invertebrate zoology, and similar articles on other small invertebrate groups are badly needed.

L. H. HYMAN

THE MORPHOLOGY AND BEHAVIOR OF THE CUSHION STAR PTERASTER TESSELATUS IVES. *University of Washington Publications in Biology, Volume 12, Number 3.*

By Irma Zintheo Rodenhouse and John E. Guberlet. University of Washington Press, Seattle. 40 cents (paper). Pp. 21–48. 1946.

This is a distinctly amateurish account that leaves the reader in an unsatisfied state of mind; neither the anatomy nor the behavior is given a thorough treatment. Although the outstanding feature of this sea star is the respiratory-brood chamber in the dorsal wall, practically nothing is said about this in the anatomical account and very little under behavior. As far as it goes, the account furnishes usable material, but it is unfortunate that a better job was not done on this interesting animal.

L. H. HYMAN

LA VIE DE L'INSECTE. *Physiologie-Biologie. Savoir en Histoire Naturelle, Volume XIV. Précis d'Entomologie, Volume IV.*

By Rémy Chauvin. Paul Lechevalier, Paris. 80 fr. (paper). 234 pp. 1943.

This is a small, inexpensively produced book that intends to give the lay reader some idea of the physiology and natural history of insects. The main topics treated are: the physiology of the chief organ systems, the behavior of insects, the life of social insects, and heredity and sex. The style is clear and simple, and the information presented is strictly modernized. The author shows evidence of being well informed in the field and gives an authoritative if brief account of the topics in question.

L. H. HYMAN

INSECT DIETARY. *An Account of the Food Habits of Insects.*

By Charles T. Brues. Harvard University Press,

Cambridge. $5.00. xxvi + 466 pp.; 22 plates. 1946.

The title of this book is somewhat misleading, in that the book deals not, as might be expected, with the nutritional requirements of insects, but rather with feeding habits and adaptations, and topics related to this main theme. It is essentially a compendium of information for the general reader and has been written in an interesting style with frequent lapses into more or less humorous remarks. The principal topics discussed are: herbivorous insects, predatory insects, galls, relations to fungi and microbes, and parasitism. Under each topic, numerous details are cited from the various orders of insects. The book is illustrated with a number of neat, clear black-and-white drawings and with 22 plates of photographs, mostly author originals. An excellent bibliography is appended to each chapter. Altogether, the book is greatly superior in originality and authenticity to the usual semi-popular books about insects and is commended to those seeking valid information in non-technical language on the topics considered.

L. H. HYMAN

STUDIES ON BRAZILIAN ANOPHELINES FROM THE NORTHEAST AND AMAZON REGIONS. *I. An Illustrated Key by Adult Female Characteristics for the Identification of Thirty-five Species of Anophelini, with Notes on the Malaria Vectors (Diptera, Culicidae). II. An Illustrated Key by Male Genitalic Characteristics for the Identification of Thirty-four Species of Anophelini, with a Note on Dissection Technique. III. An Illustrated Key by Larval Characteristics for the Identification of Thirty-two Species of Anophelini, with Descriptions of Two Larvae. The American Journal of Hygiene Monographic Series, Number 18, February 1946.*

By L. M. Deane, O. R. Causey, and M. P. Deane. The Johns Hopkins Press, Baltimore. $1.10. viii + 50 pp. + 20 plates. 1946.

Each of the three papers making up this monograph presents illustrated keys for the identification of over thirty species of Brazilian anophelines. The first key is based upon the characteristics of the adult females; the second upon the characteristics of the male genitalia; and the third upon the larval characteristics. In preparing these keys, the authors have attempted to facilitate rapid identification of important species by placing them near the beginning, according to their systematic classification rather than in groups. The keys are neatly arranged and profusely illustrated, making it possible for them to be utilized by individuals with only a basic understanding of mosquito identification. In order to insure that there will be no misunderstanding about the naming of mosquito characteristics, there are diagrams of the adult female, the male genitalia, and the fourth stage larva that clearly illustrate the taxonomically important structures. The key to the male genitalia is accompanied by excellent photomicrographs of the claspette lober and the mesosome. A simplified technique for the dissection and mounting of the male terminalia is described. The papers include notes on the distribution and breeding places of the various species and information about the vectors of malaria. References are made to the important literature on the anophelines of each area.

This authoritative monograph should be of great assistance to those responsible for malaria control in Brazil and in other areas where any of these thirty-odd species of anophelines are to be encountered. Those interested in medical entomology will desire the publication, even though they may not be directly concerned with the species of anophelines discussed.

M. M. BROOKE

THE GLOSSY SNAKE, ARIZONA, WITH DESCRIPTIONS OF NEW SUBSPECIES. *Transactions of the San Diego Society of Natural History, Volume X, Number 17.*

By Laurence M. Klauber. San Diego Society of Natural History, San Diego. 50 cents (paper). Pp. 311–398; 2 plates. 1946.

The main purpose, it would seem, in reviewing the present paper (typical of a series by the same author) is to bring it to the attention of those systematic zoologists who are not familiar with Klauber's work. His recent papers are outstanding examples of the applications of biometrical techniques to systematics.

The basic step—that which gives his work such a firm foundation—is simply stated (p. 316) in his own words: "As is my usual practice in surveying a genus, I shall first investigate degrees of dispersion and sexual dimorphism in the largest territorially homogeneous series available to me. It has been my experience that coefficients of variation and sexual divergence tend to be rather constant for each character within a genus; hence if one is able to determine their values in one area, he will be better able to evaluate any differences found between subspecies, thus to some extent compensating for inadequate material."

In addition to the modern biometrical methodology this paper is recommended to taxonomists because it contains all the requisites of a good systematic review. There is a historical summary and an account of sexual dimorphism and character variation before the genus and separate races are considered. There is also a statement on phylogeny, a series of tables of characters, a key, a bibliography, and a map of the Ben Day type. Although a spot map is usually desirable in reports of this nature, the kind used is actually preferable, since the author was able to include locality lists for each form.

There are herein recognized nine subspecies of the

monotypic snake genus, *Arizona*, which ranges through the southwestern United States and northern Mexico. The last previous reviewer, working in 1924 with but six per cent of the material now available, listed two of the present forms.

The phylogenetic diagram (p. 382) may invite some criticism since, in two instances, it shows one extant race arising directly from another; many modern systematists are inclined to believe that form B and form A arose from form pre-A, not B directly from A. In the absence of fossil evidence it is, of course, impossible to estimate whether or not A and pre-A were nomenclatorially identical.

ARNOLD B. GROBMAN

FIELD BOOK OF EASTERN BIRDS.

By Leon Augustus Hausman; illustrations by Jacob Bates Abbott. G. P. Putnam's Sons, New York. $3.75. xvi + 659 pp. + 6 plates. 1946.

The appearance of this publication on birds fills a gap that has long existed in the publisher's Nature Field Books series. It is of the same convenient size that has made the others so admirably suited for use in the field. The book is divided into three sections. The first is a field key to the bird families; the second, a key to the birds commonly seen about the home grounds; and the third, a systematically arranged description of the birds found in North America east of the Mississippi River. The field key is divided into 12 sections, the first of which is further subdivided into five groups. The key characters for separation and identification are based on habitat, size, color, and general appearance, e.g., chicken-like, duck-like; or on habits, e.g., birds of prey. It is therefore assumed that the reader has a general idea of the appearance of a chicken, duck, or bird of prey. Having identified the family, the reader is referred to the main section where keys are provided for the identification of the species. Following this key are the descriptions of the species, each of which includes field marks, field description, characteristic habits, notes, habitat, and range. Each species is given a full page, at the top of which is a pen and ink drawing of the bird. Subspecies are included in the list, with brief remarks on their distinctive features and their range.

Although only actual use in the field will reveal the faults and virtues of such a book, there are several features that might be improved. The most important one would be a better selection and more emphatic mention of those salient and distinctive identification marks for which the observer should be continually watchful. Secondly, although this manual is intended primarily for the tyro, its usefulness could be increased by descriptions and drawings of immature and fall plumages. Although there are six color plates, they all picture breeding males. Thirdly, there is too much emphasis on subspecies, and this has led to a few erroneous and misleading descriptions. For instance, both Grinnell's Water Thrush and the Louisiana Water Thrush are compared to the Northern Water Thrush, but not to each other even though the first two are different species. The Loggerhead Shrike is said to be essentially similar to the Northern Shrike, rather than to the Migrant.

The writer has followed the nomenclature of the 4th edition of the *Check-List of North American Birds*. It is to be regretted that the supplements and emendations to the *Check-List* that have appeared in the last few years were not or could not have been utilized, since many of the names are already out of date. The up-to-the-minute scientific name may be of minor import to the amateur bird student, but several concepts accepted by the previous *Check-List* are now known to be erroneous, e.g., the recognition of two races of the Black Duck, since shown to be color differences due to age. Several errors in scientific names were noted: Bombicillidae for Bombycillidae, *Cresiscus* for *Creciscus*, *Dumatella* for *Dumetella*, *pennsylvanica* for *pensylvanica*, *fosteri* for *forsteri*, *melanotus* for *melanotos*, *longiristris* for *longirostris*. In the key to the plovers there is a subheading "Head without a Crest" which apparently has no significance there. There are a bibliography and an index. The former, oddly enough, omits any reference to Bent's *Life History* volumes.

These criticisms have been inspired not because the reviewer believes the book to be valueless, but because such a book as this deserves a more critical inspection than a worthless volume would merit. The format is excellent, the drawings by Abbott are very good, and there is no doubt that this handbook will prove a useful and worthy addition to the naturalists's library.

HENRI C. SEIBERT

A LABORATORY AND FIELD MANUAL OF ORNITHOLOGY. *Revised Edition.*

By Olin Sewall Pettingill, Jr.; illustrated by Walter J. Breckenridge. Burgess Publishing Company, Minneapolis. $3.50 (paper). v + 248 pp. 1946.

This latest edition of Pettingill's manual is virtually a new publication. Almost twice the size of its predecessor, it contains much new text material and new illustrations, as well as revised portions of the old text. There are 18 sections devoted to external and internal anatomical characters, taxonomy, distribution, field identification, ecology, territory, mating, nest-building, egg-laying, parental care, and populations. After each section is a list of pertinent references, mostly from American literature. The manual has been written for college students who have had at least a year of zoology or biology.

The first part, devoted to anatomical studies, is similar to many laboratory manuals, with detailed instructions for dissection and with outline drawings to be labelled. Although most of the work should be comprehended easily enough by the average student, the reviewer is doubtful about certain sections, such as the study of the bones of the skull. A bird skull is certainly not the easiest of vertebrate skulls to work with, and a student tackling this problem should at least have had a background in comparative anatomy. Another fault lies in the failure to define or explain anatomical parts, viz., on p. 36 in the description of the skull the term "rostrum" is used without previous definition; on p. 49, although the student will no doubt guess the function of the lachrymal gland, it is doubtful that he will have as much success with the Harderian gland.

In the section on Classification and Nomenclature, a list of North American birds, down to the families, is provided, and the student is requested to learn not only the names, but their sequence as well. Instead of asking for such time-consuming labor on the part of the student (it is doubtful that many professional ornithologists would care to perform this chore from memory), it would have been preferable to insert a discussion on speciation, certainly a topic vital to all zoologists and one which has made great strides in the field of ornithology. The section on external characters is very good and precedes the key to the families wherein those characters are used.

The remaining chapters are devoted to the study of birds in the field and are well presented. The section on ecology, however, is disappointing, being one of the shortest sections in the book. This section ends with the statement that "Specific problems in the study of bird ecology are complicated, exacting, and time-consuming. They are, therefore, not considered appropriate for a beginning course in ornithology." The beginning student should find the basic principles of ecology no more difficult to learn than such facts as that the clavicle possesses an epicleidium and a hypocleidium. The material on distribution, bird communities, and bird populations is scattered in the manual when it would have been better assimilated with the section on ecology—for what is more fundamental in ecology than communities and populations?

There are seven appendices concerned with field techniques (including notes on photography), the preparation of a manuscript, and selected bibliographies. The illustrations by Breckenridge are excellent. In their appropriate places are charts, tables, forms, etc., to be filled in by the student. Altogether this is by far the most comprehensive manual of ornithology yet to appear, and it will be useful not only in the laboratory, but also as a reference book on birds, for which there is no good textbook in the English language.

HENRI C. SEIBERT

BIRDS IN KANSAS. *Report of the Kansas State Board of Agriculture, June, 1945. Volume LXIV, Number 267.*

By Arthur L. Goodrich, Jr. Kansas State Board of Agriculture, Topeka. Gratis (paper). 340 pp. + 6 plates. 1946.

This is a popular account of the birds that are or have been found in Kansas. It is in no sense a check-list, and the student of bird distribution will find little material of any value for his purposes. As a state publication intended for the public, it is quite attractive and much more informative than many other publications of a similar nature. In the first 60 pages the writer presents a broad general picture of birds and their attributes. It is naturally a cursory survey, but nevertheless well done. The constant use of such phrases and adjectives as "so-called," "it is believed," "it has been said," etc., tends to leave the reader with the impression that nothing is definitely known about birds. While caution is to be recommended, extreme conservatism belies the results of ornithological research.

The systematic list is divided into two parts, the first being a selected list of the more common birds, and the second including all the birds of Kansas. Whenever a duplication arises in the second part, there is simply a reference back to the first. The discussion for each species includes its plumage (male and female breeding), size, range, and general notes on its breeding and characteristic habits. There are six color plates, many of Fuertes' old sketches, and numerous figures from Ridgway's *Birds of North and Middle America.* Since the latter shows only features useful for generic classification, i.e., tail, wing, beak, and foot, their value in such a publication may be questioned. Subspecies are treated in footnotes.

HENRI C. SEIBERT

THE GOLDEN PLOVER *and Other Birds. American Bird Biographies, Second Series.*

By Arthur A. Allen, with plates by George Miksch Sutton. Comstock Publishing Company, Ithaca, New York. xiv + 324 pp. + 7 plates. 1939.

This second of a series of American bird biographies, now back in print, is a handsomely composed book, illustrated on every page with photographs by the author. Nearly every one of these pictures tells a story in itself and, accompanied by seven fine color plates, they alone make the book a highly desirable item. The text is written primarily for juveniles, but is full of many detailed observations that should be of interest to older naturalists as well.

The biographies are presented in the first person, as though the birds themselves were writing, a style that does not appeal to this reviewer. In spite of this, the general excellence of the book is such as to make this a

minor objection, particularly as it is written for younger readers. The book can be recommended as one that should be of considerable value to young naturalists and to those interested in teaching them.

JOHN E. CUSHING

A GUIDE TO FLORIDA ANIMALS.

By William Alphonso Murrill. Published by the author, Gainesville, Florida. $2.00 (paper). 93 pp. 1945.

Out of the rich experience of many years' original observations in the field has come this fine handbook on Florida animals. The work covers the taxonomy, habitat, natural history, and economic importance of the mammals, birds, reptiles, amphibians, fishes, mollusks, spiders, and insects native to the lands and waters of Florida. Although most of the original observations were made in the vicinity of Gainesville, the author has used many published lists and museum specimens in preparing the text.

In the concluding chapter, entitled "The Real War," the author has discussed some of the problems incident to the control of a number of insect pests. A strong plea is made for an intelligent approach to the problem —one which includes the protection of at least three of the most active natural enemies of the insects, namely, the birds, toads, and spiders. The author's keen appreciation of natural history has been combined with a delightful style of presentation in recounting the ramblings and reminiscences of a naturalist. The work may undoubtedly be well adapted for reference use by teachers and students of Florida natural history.

The volume has a short table of contents, but no index.

B. AUBREY SCHNEIDER

JUNGLE ANIMALS.

By Frank Buck ("Bring 'Em Back Alive"), written with Ferrin Fraser. Illustrated by Roger Vernam. Random House, New York. $1.00. 56 pp. 1945.

Frank Buck knows more about the wild animals of Asia and Africa in their native haunts than perhaps anyone alive. The stories and anecdotes he tells here from his personal experiences are filled with zest. The style has been excellently adapted for ten- to fourteen-year-olds, but I suspect that their elders will enjoy the book secretly, too. There is none of the insulting repetition, ad nauseam, that marks much of the writing done for children. Simple, straight narrative and description, rapidly moving, kindle interest and imagination. The illustrations are superb. Animals full of life, birds that delight in showing off their gorgeous plumage, swirling luxuriance of tropical vegetation, magnificent color—here is a real animal parade!

BENTLEY GLASS

GUIDE TO THE LITERATURE OF THE ZOOLOGICAL SCIENCES. *Revised Edition.*

By Roger C. Smith. Burgess Publishing Company Minneapolis. $2.00 (paper). vii + 114 pp. 1945.

The original edition was reviewed in 1943. (Q. R. B. 18: 279.) The revisions for the new edition are very minor. In spite of its deficiencies as a guide to the foreign literature and its entomological bias, this guide, the only one of its kind, has such a variety of useful information that every advanced zoological student will find it a useful reference.

PARASITOLOGY

BOVINE TRICHOMONIASIS. *Revised.*

By Banner Bill Morgan. Burgess Publishing Company, Minneapolis. $3.25 (paper). iv + 165 pp. + 5 plates. 1946.

For many years, veterinarians and others interested in the diseases of cattle considered *Brucella abortus*, the etiological agent of Bang's disease, as the sole cause of infertility and abortions of an infectious nature. Although the organism now known as *Trichomonas foetus* was discovered in 1888, it was not until progress had been made in the study and control of Bang's disease in the late 1920's that the association was noted between this trichomonad and the pathological conditions.

Since 1933, when *T. foetus* was first reported from cattle of the United States, numerous papers have appeared on bovine trichomoniasis. The volume of publications on the subject attests to the importance of this disease to cattle husbandry. Although the bulk of the literature has been recent, it is widely distributed through numerous journals around the world. The author of this monograph has done a valuable service to the field of veterinary medicine and parasitology by gathering the literature on bovine trichomoniasis together. He is to be commended for a clear, concise presentation of the important contributions. In presenting his own work and that of others, he has not limited himself to brief abstracts, but has included much of the original data of the various publications.

All phases of the subject are presented within the twelve chapters comprising this publication, giving a complete picture of our present knowledge of the disease. The reader is taken from a consideration of the morphology and life cycle of *Trichomonas foetus* through the symptomatology, diagnosis, and treatment of trichomoniasis, to the prevention and control of the disease within herds of cattle. In presenting the vari-

ous phases of the subject, the author has pointed out many intriguing problems still to be solved. In doing so, he has accomplished one of his desired goals in writing this monograph, namely, "to stimulate research workers and graduate students in related fields and promote them to pursue to solution the perplexing problems of *Trichomonas foetus* with which the animal disease research workers are confronted."

In an appendix, there is a parasite-host list of the genus *Trichomonas*, listing 93 species that have been found in a variety of organisms. The publication also contains several drawings of *Trichomonas foetus* and related organisms, and plates illustrating the equipment needed in the diagnosis and isolation of the organism. Another feature of the monograph that will be of particular interest to practising veterinarians is the tabulated summary of the results of treatment obtained by various authors with the drugs available. This paper-bound publication is printed in clearly readable typescript, on one side of each sheet only. The bibliography lists 447 papers.

M. M. BROOKE

ECONOMIC ZOOLOGY

TIGERS OF THE SEA.

By Charles G. Muller and Horace S. Mazet. The Westminster Press, Philadelphia. $2.00. 223 pp. 1946.

The first 174 pages of this book are given over to a story of shark fishing for older boys, which culminates in the capture of a whale shark off Cocos Island after some knife and gun play with a rival shark fishing boat. The remainder of the book is a sort of appendix on sharks, shark fishing, and a budget for a season or two in the Bahamas. This section starts out with the promising statement that "much has been written about sharks that is utterly false." However, most of the information in this book concerns the distribution of the whale shark, and that is incomplete for the Gulf of Mexico. The "financial analysis," with its tables of expected profits, looks pretty good, but many of the costs are too low for present conditions, and the sharks cannot be depended upon for full cooperation with the project.

JOEL W. HEDGPETH

ANIMAL MORPHOGENESIS

EMBRYOLOGIE CHIMIQUE.

By Jean Brachet. Masson & Cie., Paris. 420 fr. (paper). 509 pp. + 1 chart + 4 plates. 1944.

Chemical embryology as a distinct biological discipline may be said to have originated with the publication of Needham's comprehensive survey of the available literature on the subject in 1931. Since then two important books have appeared in which progress in the field has been summarized. The first of these, Needham's *Biochemistry and Morphogenesis*, appeared about four years ago, and recently *Embryologie Chimique*, by Jean Brachet of the University of Brussels, has become available in this country. The latter book undertakes to outline the present state of knowledge about the relationship between biochemical processes and such major events in embryonic development as cell division, tissue differentiation, and morphogenesis.

Brachet begins with a brief description of some of the fundamental embryological processes that have been amenable to biochemical study. Following this, there is an account of various qualitative methods that have been employed to study the chemical geography of the developing egg. In addition, there is a brief description of a number of cytochemical and histochemical techniques that have been successfully applied to the quantitative study of the metabolic processes which go on during development.

The next three chapters deal with sex determination, gametogenesis, and fertilization. There is a brief description of the classical observations of Herbst and Baltzer on sex determination in *Bonellia*, as well as a detailed account of the more controversial work of Moewus and Kuhn on the chemical basis of sex in various Chlamydomonads. Brachet concludes that sex determination in all forms, including vertebrates, is explicable on a common basis and depends upon slight changes in the structure of certain chemical compounds as, for example, in the cis- and trans- isomers of crocetin esters or in the degree of saturation of sterols. The chapter on the formation of gametes is a discussion of the results of cytochemical studies on the egg and sperm, with major emphasis on the presence and distribution of nucleoprotein. There is also a description of enzyme localization in the gametes, and the conclusion is reached that oxidative enzymes seem mainly to be associated with certain granules, whereas hydrolytic enzymes are more uniformly distributed in the hyaloplasm of the cell. A description of the interaction between egg and sperm, and of the substances released by the gametes prior to and during fertilization comprises the subject matter of chapter four. This is followed by an account, along usual lines, of the effect of fertilization on oxidative processes in the egg.

A more or less critical review of the question of cyclic variations in respiratory activity during cleavage forms the major part of the next chapter. It is concluded, from experiments with cells under anaerobic conditions or in the presence of inhibitors of respiration, that the release of energy by oxidative processes is more than a mere accessory of cell division. The chapter contains in addition a description of reversible protein denaturation during cell division and of the importance

of sulfhydryl groups in the process, and concludes with a speculative account of the similarity between cell division and muscular contraction.

Chapter 6, perhaps the most interesting part of the book, is an account of the author's studies and those of Caspersson and his school on nucleoprotein metabolism during development. From studies on a number of species, evidence is presented that thymonucleic acid is synthesized in the embryo from a precursor store of ribose nucleic acid (phytonucleic acid). Certain granules, which can be isolated from the embryonic cell as well as from the liver and other organs by ultracentrifugation, have been shown to be particularly rich in ribose nucleic acid. According to Brachet, these granules may be considered as important sites of intracellular synthesis, for it seems clear that synthesis, particularly of protein, is most intense in those regions of the cell where nucleoproteins are the most concentrated. The granules are likewise the carriers of a great variety of enzymes including cytochrome oxidase, succinic dehydrogenase, and a series of hydrolytic enzymes.

Chapter 7 deals primarily with metabolic events during the later stages of development and with the controversial question of the energetics of such processes as growth and differentiation. In addition, there is a brief account of variations in aerobic and anaerobic metabolism during development and of the sequence of energy sources used by the embryo. In chapter 8, work on the metabolism of the eggs of invertebrates is presented, together with a fairly comprehensive review of the work of the Scandinavian school on the gradient systems in the echinoderm egg. This is followed, in chapter 9, by a description of metabolic processes in the developing amphibian egg.

The problem of induction and of the nature and release of inducing substances from inactive precursors is discussed in chapter 10. There is a complete account of the large amount of work that has been done on the metabolism of the organizer region. The final chapter recapitulates the major subjects and conclusions and also reenumerates various controversial points.

Taken as a whole, the *Embryologie Chimique* represents a valuable addition to the literature of its field. Evidence of this is the fact that the book has already gone through a second edition. The presentation of the subject matter in most cases is a straightforward account of experimental data, without much attempt at critical evaluation. However, in certain sections, particularly in the discussion of nucleoprotein metabolism in the embryo, the author permits himself to engage in somewhat speculative accounts. Although some of the author's views may not withstand critical analysis, they are nevertheless valuable and provocative and should provide a stimulus for future investigation.

EDGAR J. BOELL

HUMAN EMBRYOLOGY.

By Bradley M. Patten. The Blakiston Company, Philadelphia and Toronto. $7.00. xvi + 776 pp. 1946.

This well organized, well written, and superbly illustrated text at once takes its place in the forefront of the works in its field. Life the author's previous books on the development of the chick and of the pig (which are dwarfed by the present volume), this text will surely win wide and deserved acceptance.

Writing especially for medical students, the author has included sections on the very early stages of embryo formation, on implantation, on various endocrinological relationships, and on histogenesis. Throughout the book, each section ends with a presentation, sometimes covering up to ten pages, of the developmental abnormalities characteristic of the particular region or organ system under consideration. The account of organogenesis is well integrated with the facts of adult human anatomy by the inclusion of key figures from various standard treatises, and by other means. Profitable laboratory work is facilitated by pertinent references and figures of pig development. References to comparative embryology have purposefully been held down, but are there when needed, notably in the discussion of the early development of the primates, of the origin of muscles, and the formation of the kidneys.

The illustrations, sometimes in colors, are of many types, all excellent, and are derived from a wide variety of sources including much original material. The temptation to pick out specific ones for commendation is great, especially among those from the Carnegie *Contributions to Embryology*.

The text is clear and readable, the material inclusive —everything is here, from the persistent canals of Nuck to the embryology of freckles—, and usually up to date —the ductus arteriosus closes actively, and German measles damage the corneas of the unborn. Among the few items that missed this edition are the rhesus factor and the newer knowledge of the autonomous as contrasted with the hormonal differentiation of sexual structures. Much sound common sense is displayed, as, for example, in the interpretation of the origin of the extrinsic muscles of the eye. The present reviewer heartily agrees that it is absurd to call the genital tubercle the "phallus," but is not the plain Greek meaning of the word enough to disqualify it except as a synonym for penis?

It is inevitable that in a work of this size and scope some of the ideas will be challenged. The emphasis on neuromeres as inherent in the central nervous system is a dubious business. The references to heredity have a dated, almost Galtonian sound, e.g.: "Only half of one's hereditary potentialities come from one's immediate parents, whereas the other half is a mosaic of traits from more remote ancestors." The author states that he has been writing this book over a period of many years. Very probably the antiquated remarks on

heredity are merely clippings from some old notebook that have become imbedded in what is, in other respects, a work unexcelled.

GAIRDNER MOMENT

THE FOETAL CIRCULATION *and Cardiovascular System, and the Changes That They Undergo at Birth. By Alfred E. Barclay, Kenneth J. Franklin, and Marjorie M. L. Prichard. Charles C. Thomas, Springfield.* $10.00. xvi + 275 pp. 1945.

This book bears testimony anew to the value of cooperative research effort, to the value of applying new and highly specialized technics to the advancement of our knowledge of one of the oldest problems of growth and development, and to the value of ample publication, without restriction of text or figures. These three features combine to make this a monograph which is unique in scientific publications in recent times.

The cooperative side of this work is broader than the list of three authors suggests. A. E. Barclay and Miss Prichard comprised the radiological experts of the team. K. J. Franklin, until 1946 dean of the medical faculty at Oxford, is a pharmacologist, and an authority on the cardiovascular system. He is noted as an investigator in the latter field, and as author of a monograph on veins. His interests extend deeply into the history of medicine. As a result, one of the major contributions in this monograph is a scholarly review, in Chapter I, of the development of our knowledge regarding the fetal circulation, from which the experimental work of this book stems with reasoned logic and great effectiveness. Other contributors to whom the authors make generous acknowledgment are: members of the Royal Veterinary College, particularly Amoroso, a skillful morphologist; Joseph Barcroft, the eminent physiologist of Cambridge; and Barron, now of Yale University, but who at the time was associated with Sir Joseph. Fetal studies were undertaken, in fact, in the Nuffield Institute at Oxford in 1937, following the suggestion of the Cambridge physiologists that the technic of cineradiography could reveal the course of blood flow in the mammalian heart before, during, and after birth. Fortunately for all who are, or who ever may be, interested in this subject, a happy union of knowledge, skills, and essential financial support was achieved. The result of this combination of abilities and interests is impressive, indeed. This success was achieved, moreover, during the darkest years of war for Great Britain. Countless students of the subject now and yet to come will be grateful for the effort these authors made.

The technic of cineradiography as applied to fetal and neo-natal studies is well set forth in the second chapter. Here one is easily satisfied, both by the magnificent series of plates (showing sequences of the passage of contrast-medium at several frames per second) and by the concise but adequate description of the technic. With proper regard for the knowledge of the average reader, the technic is described first as it applies to the adult heart. The conclusions to be derived from these cineradiographs are summarized in richly colored line drawings, which are composite interpretations. These show the course of the blood-flow through the heart, and in the large vessels leading to, and from it. This is done for different series of frames when the injection-mass is delivered into various parts of the vascular system. With this introduction to the technic as a basis, there follows a similar treatment of conditions observed in the fetal lamb, before and after functional closure of the ductus arteriosus. Part III (consisting of Chapters III-VI) reviews in detail the "full story" (authors' words) in a particular species, namely the sheep (*Ovis aries*). In quite dramatic sequence there follow a detailed description of the morphology of the cardiovascular system, of the circulation in the mature fetal lamb, of the birth of the lamb and the rupture of the umbilical cord, and of the changes that occur during and shortly after the birth of the lamb. Old terminology, reflecting the confused history of the development of the subject, is found both deficient and inaccurate. Accordingly, a glossary of new names, derived from the old when feasible, is set forth for those who would work in this field.

The primary contribution of the authors is contained in the account of the foregoing work. For the sake of completeness, however, two more sections are provided. The first of these is concerned largely with the comparative anatomy of the fetal and placental vascular systems. The account of the placental circulation adopts the currently favored viewpoint summarized some years ago by Mossman. Abundant new data are given in this book for a variety of interesting and curious species of animals. These data touch upon most parts of the fetal cardiovascular system. The final section reviews the cardiovascular system of the human fetus. The two last sections constitute a review rather more than they do a report of the results of these investigators. For any interested in comparative morphology, however, these sections will be rewarding for their scope and for much new material.

The general nature of the text of this book will be somewhat provocative to many physiologists. The style, which is always interesting although not always easy to read, conveys a certain sense of finality, and disposes time and again of literature which lacks a functional outlook. If, however, a consistently functional outlook were to be maintained, one would question whether it may be so readily assumed at the outset of the book that delivering the fetus through the uterus has no important effect upon the level of activity of the fetal cardiovascular system. We learn nothing, moreover, of the cardiac reserve of the fetus during the period prior to birth, and of the way in which this permits

adaptation to, and preparation of the cardiovascular system for, the stresses of delivery. The bibliography, which is extensive and valuable, lacks references to many important publications and so there tends to be a favoring of work which, though excellent, is not necessarily the last word on the subject. The consideration of the development of respiratory mechanisms is a case in point. On the whole, the historical literature seems to be more adequately covered than modern contributions.

The third outstanding virtue of this work, that of ample publication, deserves comment in concluding. Although this edition of the book bears the imprint of C. C. Thomas, it should be noted that it is a reprint made by the original British printer, and bound in this country. The high quality of the original edition, published in 1944, is found, accordingly, in this edition too. The format of the book is well arranged with respect to typography, headings, figures, index, and bibliography. The paper is heavily sized and gives maximum effectiveness to the numerous half-tone and colored illustrations.

S. R. M. REYNOLDS

PHYSICAL GROWTH FROM BIRTH TO TWO YEARS: I. STATURE. *A Review and Synthesis of North American Research for the Period 1850–1941. University of Iowa Studies, Studies in Child Welfare, Volume XIX.*

By Howard V. Meredith. University of Iowa Press, Iowa City. $1.50 (paper). viii + 256 pp. + 23 tables. 1943.

ANIMAL MORPHOLOGY

ANTHROPOID AND HUMAN ENDOCRANIAL CASTS.

By Pierre Hirschler. N.V. Noord-Hollandsche Uitgevers Maatschappij, Amsterdam. f 4.75 (paper). x + 150 pp.; 11 plates. 1942.

This M. D. dissertation, suggested and directed by the late C. U. A. Kappers, deals with the size, shape, and surface markings of the casts of the endocranial cavities in recent higher primates. There has accumulated a very considerable literature on the endocranial casts of most of the important fossil men and apes, and it includes some rather doubtful deductions. The present, carefully prepared paper will be specially—if not exclusively—useful in future studies on endocranial casts of fossil finds. It contains an extensive, critical survey of the relevant literature with corresponding bibliography, it describes minutely the laborious method for making casts of brain-cavities without, however, contributing any improvements to the generally used procedure, and it describes and illustrates in conscientious detail the perfect endocranial casts of a gibbon, an orang, a gorilla, a chimpanzee, 32 Chinese, and a few other modern men. The conclusion is reached that the endocranial casts of these various higher primates differ generically in regard to shape and proportions, man being quite apart from the rest. The detailed and widely varying surface markings permit no broader generalizations. They can be correlated with a variety of anatomical factors in individually very different degrees. Fissural, circulatory, and sutural markings are apparently often indistinguishable and cannot be interpreted with as much certainty as has been assumed by some previous investigators.

A. H. SCHULTZ

ANATOMY AND PHYSIOLOGY. *Third Edition.*

By Frederic Theodore Jung and Elizabeth Carpenter Earle. F. A. Davis Company, Philadelphia. $4.00. xvi + 829 pp. 1945.

The popularity achieved by the earlier editions of this excellent text has warranted the appearance of the present third edition. The work is intended primarily for use in the introductory course of anatomy and physiology for student nurses, but sufficient material is presented to meet the requirements of any introductory college course in the field.

The authors have followed the organ system method of presentation, each topic being discussed thoroughly from the anatomical, and then from the physiological point of view. Just as the anatomical features of the human body make up its framework, so the anatomical discussions form the framework of the text, while physiological considerations make up the theme of the work. In order to emphasize the human body as a highly complex, though completely integrated whole, each organ system is carefully related to all others and to the normal functioning of the whole body. The treatment of the subject matter is sound, and it is presented in such a manner that it provides for a wide variety of teaching methods and student abilities. Opportunity is provided for a proper balance between teacher and student activity throughout the course. Each chapter is concluded with a list of suggested laboratory exercises and study projects, as well as a detailed summary of the material covered therein.

The text is abundantly and beautifully illustrated by more than 335 drawings and photographs, many of which are colored for the purpose of emphasizing certain structural details. A complete, 33-page index serves the volume well for quick reference work. The present edition of this well established work will certainly uphold its former reputation in the field of anatomy and physiology textbooks.

B. AUBREY SCHNEIDER

LABORATORY MANUAL OF ANATOMY AND PHYSIOLOGY. *With An Outline for Teachers.*

By Nellie D. Millard and Mary Jane C. Showers. W. B. Saunders Company, Philadelphia and London. $1.00 (paper). viii + 119 pp.; (outline) 23 pp. 1946.

This manual, planned to go with the textbook *Human Anatomy and Physiology*, by Millard and King (reviewed Q. R. B. 21: 95. 1946), provides 30 lessons grouped into five units: The Body as an Integrated Whole; The Erect and Moving Body; Maintaining the Metabolism of the Body; Reproduction in the Human Being; Integration and Control of Body by the Nervous System. The manual is very well printed, on paper of good quality for drawing, and usually, though not always, on one side only. However, the student is not expected to draw very much, as good outline drawings to be labeled have been provided at every opportunity.

In unit III there is heavy emphasis on circulation and respiration. Nowhere is the existence of endocrine glands and the hormonal integration and control of the body so much as mentioned.

The little booklet called *An Outline for Teachers* is actually no outline at all, but a guide to preparation for the laboratory work, with occasional suggestions for its coordination with the classwork and use of the textbook. It should be very helpful to the busy instructor. More such aids would be welcome.

BENTLEY GLASS

ANYONE CAN DRAW ANIMALS.

By Arthur Zaidenberg. Pitman Publishing Corporation, New York and Chicago. $3.00. vi + 170 pp. 1946.

Judging by the title of his book, the author is an optimist, and it is to be wished that his encouraging and instructive collection of attractive sketches of animals will be used with faith and hope by many zoologists. There is no better method for teaching accurate and thorough observation than drawing what one sees, and a competent drawing is a more efficient record of what one has seen than any number of descriptive words. Good drawing, like good writing, has to be taught and practised; and for both arts practice, though more time-consuming, is far more important than teaching. Furthermore, practice encourages, whereas teaching discourages, originality.

In the extremely brief text of this book the artist-author states that in drawing "the main problem ... is learning to *see*". With his 150 drawings he shows animals first in their simple, basic forms of structure, and then in their essential characters, without meaningless detail. The illustrations represent a great variety of mammals and a few birds, most of them in action and a few in repose. All are more or less unfinished, rapid sketches from life, made with pencil, crayon, or dry brush. By far the best drawings are those of horses, cats, and dogs, animals with which the author is evidently especially familiar. The sketches of cattle, goats, sheep, and pigs appear by contrast somewhat crude, and the picture of a gnu is so poor that one suspects it was the first and only gnu ever seen by the artist. One learns to see and to draw well only by drawing the same object again and again.

A. H. SCHULTZ

ANIMAL PHYSIOLOGY

ANNUAL REVIEW OF PHYSIOLOGY. *Volume VIII. Edited by James Murray Luck and Victor E. Hall. Annual Reviews, Inc., Stanford University, California.* $5.00. viii + 658 pp. 1946.

The current volume contains twenty-five reviews, as follows: Effects of Ultraviolet Radiation, by A. Hollaender; Physiological Aspects of Genetics, by C. H. Danforth; Developmental Physiology, by L. B. Flexner; Physiology of Heat and Cold, by J. R. Brobeck; Energy Metabolism, by T. M. Carpenter; Respiration, by L. F. Nims; Physiology of the Skin, by S. Rothman and Z. Felsher; Digestive System, by J. P. Quigley; Liver and Bile, by S. Freeman; Kidney, by R. F. Pitts; Blood Coagulation, Thrombosis, and Hemorrhagic Disorders, by J. H. Ferguson; Blood Cytology, by G. M. Higgins; The Lymphatic System, by O. Cope and L. Rosenfeld; Heart, by H. E. Hoff; Shock, by M. I. Gregersen; Nerve and Synaptic Conduction, by G. H. Bishop; Visceral Functions of the Nervous System, by K. Hare; Somatic Functions of the Central Nervous System, by A. E. Walker; Audition, by E. G. Wever; Metabolic Functions of the Endocrine Glands, by E. W. Dempsey; Reproduction, by C. W. Hooker; Aviation Physiology, by C. L. Gemmill; Physiological Psychology, by R. H. Seashore; Applied Psychology, by R. E. Johnson; Pharmacology, by M. L. Tainter, L. C. Miller, and T. J. Becker. Subject and author indexes fill 76 pages.

There is certainly something here for every man, and far too much for any man. The average review cites 8 papers per page, which allows on the average five lines of summary and comment on each paper. But there is a great range, as was true in earlier volumes, between the least and the most condensed. One reviewer (physiological psychology) has discussed an average of one paper per page, certainly an allowance liberal enough for a complete and critical review of the subject. Another (blood coagulation) has performed the astonishing feat of mentioning more than 16 papers per page of his review. It is no wonder that it reads like a string of technical names and titles

of papers. The question should again be raised whether it is a good thing to mix critical reviews and mere indexes of the literature. Both have their uses, but they are very different uses. Since the majority of the reviews here are in reality little more than indexes, the critical reviews among them are lost as critical reviews, and the entire volume tends to become one used for reference only. Moreover, if indexing is to be the real character of the *Annual Reviews*, why not openly call them indexes and adopt the most effective and economical methods of indexing? For additional comment on this suggestion, see the review of the Bibliography and Index of Geology Exclusive of North America, Volume X, reviewed on p. 371 of this issue.

BENTLEY GLASS

CARBOHYDRATE METABOLISM: *Correlation of Physiological, Biochemical and Clinical Aspects.*

By Samuel Soskin and Rachmiel Levine. University of Chicago Press, Chicago. $6.00. viii + 315 pp. 1946.

This volume is intended to serve as a correlative text for the teaching of carbohydrate metabolism to students of physiology, biochemistry, and medicine. Students will find the book interesting and stimulating, for it summarizes, in a comprehensive manner, information usually taught in several different courses.

Despite its title, the book deals in considerable detail with certain aspects of protein and fat metabolism, recognizing that the traditional separation of the metabolism of the three chief foodstuffs is largely artificial. This is clearly brought out in the excellent discussion of the meaning and interpretation of the respiratory quotient (R. Q.). It is interestingly and correctly pointed out that because of its composite nature the R. Q. has very little quantitative value concerning the dissimilation of foodstuff. Even with isolated tissues it can serve only as supplementary information, as a check on direct chemical analysis. Numerous examples and experiments are presented to support this conclusion.

The book is divided into five parts: The Biochemistry and Energetics of Carbohydrate Metabolism; Introductory Physiological Considerations; Critical Survey of the Classical Criteria of Diabetes; The Role of the Endocrine Glands in Carbohydrate Metabolism; Integration of Physiological and Clinical Aspects.

In Part 1, the importance of carbohydrates in nutrition is briefly discussed, and then the enzymatic machinery for the degradation of these carbohydrates by cells and tissues is considered. The important intermediate steps of phosphorylation, transphosphorylation, the generation of energy-rich phosphate bonds by oxidation-reduction reactions and dehydration and the transport of electrons (hydrogen) by various carriers are all discussed. Finally, the utilization of the energy derived from the breakdown of carbohydrates is considered, primarily from the standpoint of muscular contraction. Numerous figures and diagrams, including a number of interesting analogies, help to make the presentation of this part quite clear even to those not familiar with the field.

In Part 2, the nature and occurrence in the tissues of materials important to carbohydrate metabolism, such as glucose, glycogen, lactic acid, pyruvic acid, and phosphate compounds, are discussed, as well as the site of origin of blood sugar. The use of the diabetic organism in the study of gluconeogenesis and the non-utilization and overproduction theories of diabetes are considered in some detail.

In Part 3, the quantitative excretion of administered sugar, the dextrose:nitrogen ratio, ketosis, the respiratory quotient, gluconeogenesis from fat and protein, and the utilization, dissimilation, and oxidation of carbohydrates are discussed. Besides the respiratory quotient already mentioned, favorable comment of a similar sort should be made for the authors' discussion of the dextrose-nitrogen ratio.

In Parts 4 and 5, the actions of the various factors from the endocrine glands upon carbohydrate metabolism are considered and finally correlated with the clinical aspects. It is important that the authors point out that diabetes mellitus, as it occurs in man, is still a clinical syndrome of unknown etiology, with essential and minimal characteristics of a persistent hyperglycemia with glycosuria. This being the case, they further point out that these conditions may be caused in a variety of ways, and not merely by insulin lack. Thus there may eventually be distinguished several different types of diabetes (pancreatic, pituitary, adrenal cortical, thyroid, and hepatic). The last two chapters deal with the comparative physiology of diabetes and present frontiers of research in metabolism.

The book contains over 1200 selected references, forty-two tables and 75 figures, the latter including many interesting analogies.

W. D. MCELROY

ELECTROCARDIOGRAPHY *Including an Atlas of Electrocardiograms. Second Edition.*

By Louis N. Katz. Lea & Febiger, Philadelphia. $12.00. 883 pp. 1946.

This handsome volume presents the subject of electrocardiography in a most comprehensive and detailed manner. The illustrations are excellent, and include over 1000 carefully analyzed electrocardiograms that provide an atlas with which to compare almost any record the reader is likely to encounter. One can but

express admiration for the author who manifests such mastery of the almost infinite variations in contour exhibited by the normal and abnormal electrocardiogram, and who imparts his knowledge to others with such enthusiasm and good will. Many of the concepts expressed are the author's own, and are based on extensive research which has been previously published.

The second edition is considerably longer, but on the whole much better than the first. Additions include a section on terminology, with the universal nomenclature recently established by the American Heart Association; a section on the principles involved in the electrical manifestations of the heart; a discussion of normal variations and the effect of posture, body build, and physiological state of the subject on the electrocardiogram; and a description of a third chest lead, lead CF5, and its uses.

This is not a book for beginners, despite the innovation in this new edition of outlining the salient features of each type of electrocardiogram in a special table. Even for the trained electrocardiographer, the descriptions often seem too long and involved, and one is constantly aware of the contrast between the meticulous description of slight variations in contour and the present uncertainty as to the anatomical or clinical significance of many of these variations. Thus, twenty pages are devoted to intraventricular block and its various types, although it is stated that "it is not the variety but the presence or absence of intraventricular block which is important, and the key to the presence of intraventricular block is prolonged QRS duration." Classical concepts and controversial subjects, such as the development of "heart strain," are not always clearly distinguished, so that one should compare the interpretations presented here with those of other authors. There is no doubt, however, that the magnitude and challenging approach of this work make it an essential reference book for all advanced electrocardiographers.

CAROLINE B. THOMAS

EXERCISES IN ELECTROCARDIOGRAPHIC INTERPRETATION. *Second Edition.*

By Louis N. Katz. Lea & Febiger, Philadelphia. $6.00. 288 pp. 1946.

This is a companion volume to the *Electrocardiography* reviewed above, and is equally attractive in format. It may be used separately or with the *Electrocardiography*, and is especially useful in helping the physician with some experience in reading electrocardiograms to improve his own interpretations. One hundred electrocardiograms are presented, with the description and interpretation of each on the opposite page, and, in addition, a brief statement of the patient's clinical status. This book will provide excellent practice in the reading of unknown electrocardiograms.

CAROLINE B. THOMAS

BIOLOGIE DE LA VISION.

By Marie-Louise Verrier. Librairie Armand Colin, Paris. 42 fr. (paper). ix + 214 pp. 1945.

This small book attempts to explore the correlations of various ophthalmic structures and functions with habitat, responses, and general activity of species, from the annelids up.

The author is minded not to seek regularities in nature, but to call attention to the ubiquitous exceptions from regularity. VonKries' duplexity theory is shown to apply only to a few extreme cases, the mass being hopelessly contradictory and confused in terms of any universals. Walls' theory of transmutations is shown as pure supposition, without experimental basis or predictive power. Teleology, or adaptive fit of the eye with habit, proves very shaky. Exner's theory of apposite and superposite arthropod eyes is notable more for its exceptions than its validity. Lapique's notion of parallel development of eye and brain appears to be contrary to fact. Yet the book is filled with curious data, especially on a great variety of fish and birds hitherto not given in texts. An unusually complete account of the retinal pigment is given. The author uses Cajal's outdated neurohistology.

Adversely, one notices too ready conclusions from few data: e.g., acuity is discussed from imagery and retina, without reference to size of pupil; there is facile passage from invertebrate to vertebrate without attention to the fine-structure of the receptor. In short, impressions abound, but there is no exhaustive discussion of any feature or function. References are sparse, though much of the work is the author's own. The book would seem more useful to the taxonomist than to the analytical physiologist. It does summarize Continental contributions otherwise inaccessible.

S. A. TALBOT

THE SEXUAL BEHAVIOR OF ANURA: *2. Neural Mechanisms Controlling Mating in the Male Leopard Frog, Rana Pipiens. Bulletin of the American Museum of Natural History, Volume 86, Article 3.*

By Lester R. Aronson and G. Kingsley Noble. American Museum of Natural History, New York. 60 cents (paper). Pp. 83-140. 1945.

It is testimony to the stimulating personablity of G. Kingsley Noble that four years after his death Lester Aronson has carried to completion a very painstaking

and significant piece of work which they jointly initiated. Utilizing the technique of inducing sexual activity by anterior pituitary hormone injection in the male frog, Aronson has either extirpated portions of the brain or transected the brain at various levels, to determine the variations thereby caused in the pattern of sex behavior as compared with that of the controls, which were similarly stimulated but not surgically treated. He describes six phases in the sex activity of the male frog and localizes the controlling centers as follows:

1. Swimming response—midbrain (dependent for support upon the forebrain)
2. Clasp response—spinal cord.
3. Warning croak—midbrain (inferior colliculi)
4. Sex call—midbrain
5. Spawning movements—midbrain (tegmentum)
6. Release of female—midbrain (pars dorsalis hypothalami and preaptic region)

Numerous frogs were operated upon and many brains were serially sectioned and studied in histological detail after collecting the behavioral data. Obviously, no two surgical operations on such a small organ as the frog's brain could be histologically identical, hence the work is primarily of qualitative value, pointing the way for quantitative confirmation.

In a manner reminiscent of the older psychology textbooks that dealt with absolute cortical localizations in the human brain, Aronson presents a diagrammatic sagittal section of the brain of *Rana pipiens* on which the centers for four of the six phases of sex activity are indicated. It is noted that the midbrain seems to be the center for most of the controls of sex behavior.

There is no doubt but that this is a major contribution to the ultimate understanding of neurophysiological relationships. The following comments are offered, therefore, in the nature of constructive suggestions for further investigations.

(1) The anterior pituitary gland was used to stimulate sex activity, including all six of the phases described. However, this gland was not extirpated, and the animal was not studied for loss of integrated behavior. It has long been known that ovulation in the female can be induced with a lesser dose of the anterior pituitary hormone when the recipient has been hypophysectomized. This gland is of forebrain origin (infundibulum) along with the invaginated (hypophyseal) ectoderm.

(2) One must distinguish between reception centers and effector centers. The midbrain gives rise to the 3rd and 4th cranial nerves, whose injury might well affect the behavioral pattern of the operated male frog. Speaking of the swimming response, the author states: "It is not until the midbrain is destroyed that the response is completely lost." But such destruction not only involves the midbrain effectors, but also any integrative control emanating from the forebrain (including the pituitary gland).

(3) The author states (p. 129) that the precise definition of anatomical and physiological centers and systems still remains a major tool in the hands of the neurological investigator (Bard, 1939), providing one constantly bears in mind that these localized areas and systems do not function independently in the intact animal;—yet, on page 133, in regard to these six phases of frog sex behavior, occurs the statement: "Each of the behavioral items studied appears to function *relatively independently* of the neural mechanism important for the other phases."

(4) It is precarious to compare neurological (or any) phenomena of such unrelated forms as the frog and mammal. Human localizations (if valid) are presumed to be cortical, whereas the entire brain substance is involved in the diagram for the frog (p. 135). References to Beach's (1944) work on the rat support this contention.

(5) Finally, a relatively minor point concerns the use of the word "estrus" for the "fully ovulated" female frog. Estrus means a "period of the reproductive cycle of the mammal when the uterus is prepared for implantation of the ovum," and the definition refers to "estrin," which is a hormone found in the mammalian ovarian follicle. There is, as yet, no evidence of such a hormone in the frog ovary and the frog has no phase comparable to the estrus cycle.

Aronson's work is a substantial contribution to the understanding of the neuro-physiology of sex behavior in the male frog, *Rana pipiens*.

ROBERTS RUGH

ENDOCRINOLOGIE DE LA GESTATION.

By Robert Courrier. Masson et Cie., Paris. 465 fr. (paper). x + 399 pp. + 11 plates. 1945.

When a curtain of darkness descended upon a fallen France, our contact with the well-springs of intellectual and scientific thought in France was lost. It was impossible to know what had become of the men and women of science beyond that curtain, or to the spirit which gives rise to creative work. Here, in this book, there is eloquent testimony to the surviving quality of that spirit in the face of adversity. Indeed, so comprehensive and well-reasoned is this book that a discerning reader will be inclined to suspect that scientific productivity in our own country must have seemed to be under a very dark cloud indeed to Courrier and his colleagues even before 1944. This is suggested by his comment in the preface, where he speaks of the continuing evolution of the subject-matter and of increasing publications. Facts will remain, he says, but our interpretation of them must change in accordance with new facts. He continues:

"Nous avons écrit ce livre au cours de sombres années, et, depuis 1941, nous n'avons pu prendre connaissance de travaux de langue anglaise."

The publication of a new book by Courrier is always an important event. One has only to consider his past and present stature to appreciate this. He was trained by the master, Pol Bouin. From him he learned the value of precision in morphological details and gained an insight into histo-physiology. Then, after serving as an associate of Bouin at Strasbourg, Courrier served as professor of histology and embryology on the faculty of medicine at the university in Algiers. Since 1937 he has occupied in France the preeminent position in his field, as a member of the Institute of the Academy of Medicine and as Professeur au Collège de France. In these situations he has distinguished himself as a prodigious and productive investigator and as an effective teacher, if one may judge from the published work of his former students in France, Belgium, and Algiers. In World War I, Courrier served with such distinction that his country bestowed great honors upon him, among them the Croix de Guerre and the order of Chevalier de la Legion d'Honneur. In World War II, Courrier served science by writing this monograph. He should receive from scientists engaged in this field of work high recognition, comparable to that which he received from his country in the earlier World War. What is the nature of his contribution?

The problem of the endocrinology of gestation dominates the larger one of genital physiology. It takes into account those factors which determine the establishment of pregnancy, which maintain it, and bring it to a successful end at term. Reproductive function, according to Courrier, is predominantly hormonal, from ovulation to lactation. It is not enough for the ovary merely to discharge its ova periodically (in most species); it must also secrete those hormones which govern to a large degree the genito-mammary apparatus. By their influence on the vagina, on the uterus, and on the oviduct, the ovarian hormones control mating, and promote the union of the gametes, the migration of the fertilized ovum, and its survival and implantation in the uterus. This is part of the story Courrier tells.

Other hormones, particularly those of the hypophysis and placenta, take their part in the "harmonious concert" of the endocrinology of gestation. There is, in all of this, a succession of equilibria upon which the successful course of pregnancy, parturition, and lactation depend. These matters, too, are given careful consideration. The role of the nervous system in reproductive phenomena has been subordinated by our knowledge of endocrine mechanisms. In reality, the nervous and endocrine processes are in close communion; witness, for example, the neuro-humoral reflexes which represent a kind of chemical transmission to the effector organs. Courrier considers the various manifestations of these mechanisms in different species with respect to gestation. These facts are, by and large, familiar to students of the subject. For what, then, are we particularly indebted to Courrier?

Among the noteworthy virtues of this book is the organization of an enormously complex subject into a simple, logical sequence. This is explained, perhaps, by the fact that the book is, in essence, the substance of forty lectures given by the author at the Collège de France. The subject is presented in five broad sections that consist of three to six chapters each. The first deals with the "installation" of pregnancy (the gametes; the migratory paths of the genital tract; the morphology of placentation; extra-uterine pregnancy; delayed implantation; the duration of pregnancy). The second section describes the transformations that take place in certain organs during pregnancy (the ovary during gestation; the gravid uterus; the pelvic ligaments; the vaginal epithelium and sex-skin; the oviduct; the mammary gland). In the third section, the hormones found in the body fluids and tissues are discussed (structure of steroid hormones; estrogens; progesterone and the pregnandiols; gonadotropic substances; posterior pituitary and oxytocic substances; androgens). These first three sections, each one an interesting and stimulating discussion in its own right, provide the base upon which the fourth section rests, and which in turn illuminates the first three. The fourth section deals with experimental factors that play a role in gestation (the endocrine factors which interrupt gestation; the factors which maintain gestation; the factors which prolong gestation). The final section in the book is the considered conclusion of the author regarding the interplay of the endocrine factors that govern normal pregnancy. It is entitled: The hypophysis-corpus luteum-placenta system. It contains chapters on the endocrine functions of the placenta; on hormonal equilibria in pregnancy and parturition (aging of the placenta); and on the placental transmission of hormones.

Numerous interesting and provocative ideas are set forth in this book. Reference may be made to just one, as an example. Through the book, evidence is adduced to show that in some species pregnancy will continue after ovariectomy at specific times during pregnancy; in other species, it cannot. The rabbit is one of the latter. Plate VII, however, shows a picture of a fetus that was still living in an untreated ovariectomized rabbit nine days after operation. This result was accomplished by delivering the fetus through the uterus, with subsequent revascularization of the placenta through attachment onto the mesentery. Litter-mates which remained untouched *in utero* died within a few hours after castration. This experiment gives point to the author's thesis that the hormones in pregnancy serve primarily during late pergnancy to maintain a favorable maternal environment after placentation, through the agency of mechanisms of

uterine accommodation; and that pregnancy comes to an end by the process of parturition or by death of the fetus when the local limit of uterine accommodation, endocrinologically speaking, is reached.

The volume is not at all slender. Even so, Courrier remarks that a "voluminous" work would be required to write about all that is known of the endocrinology of gestation. No one will disagree. Courrier was forced to write, fortunately for the reader, a shorter book. As it stands, it constitutes a body of essential facts which he has endeavored to place properly, but which he admits will require subsequent enlargement and re-orientation. This, it seems, is the primary contribution of Courrier here. Not all investigators will agree in entirety, partly because facts which are contained in the literature of recent years were not available to the author while he wrote, and in part because of the different degrees of importance inevitably attached to the same set of facts by different investigators. These instances are few, however, for we are beneficiaries of a disciplined and experienced scientist who is also a teacher.

American students of endocrinology will value other features almost as highly as those mentioned above. The book is well annotated. There is a bibliography of more than twelve hundred references, with titles cited, many of them known to American workers, but a wealth of the less familiar from the European literature. Though some of these are old, they have not been duly appreciated by workers in this country. Many others are references to French, Belgian, German, and Swiss papers that were published during the war and are not generally available, even now. Another virtue of this book is the *systematic* comparative treatment of all the points discussed. In general, a summary statement is made at the end of each discussion of a topic, whenever it is possible with profit.

The format of the book is excellent, despite publication in Paris during difficult war years. The type is attractive, errors very few, and the paper is of good quality. Line cuts are well proportioned, and the plates are of superior grade.

The "somber years" came to an end in 1945. As soon as it was feasible for him to do so, early in 1946, Courrier visited many laboratories in North America. He came here to learn, but he left behind him here a host of appreciative colleagues who now realize to what an extent the creative spirit can carry a man through adversity.

S. R. M. REYNOLDS

ENCYCLOPEDIA OF ENDOCRINOLOGY. *Section IV. Ovary, Volume VII. Ovarian Tumors. Section IV. Ovary, Volume VII. Bibliography. Ovarian Tumors (Bibliography).*

By Hans Selye. Richardson, Bond and Wright, Montreal. $21.75 (2 volumes). vi + 289 pp. + 60 pp. + 38 plates; vi + 427 pp. 1946.

Hans Selye has now presented us with a two-volume work on ovarian tumors as part of his Encyclopedia on Endocrinology. It is a truly encyclopedic treatise, containing the most complete presentation of this subject thus far written. Only a writer versed in such diverse fields as clinical medicine, pathology, and physiology could have undertaken to compile it. The great erudition and knowledge necessary to complete it can hardly be overestimated. The author, one of the worlds most polyglot biologists, has succeeded in compressing his digest of 15,000 references into a simple and readable text. In order to minimize the possibilities of error, the entire bibliography was printed with Electromatic typewriters, was subsequently reproduced by a photographic process, and finally was checked against the original articles. I have checked a great number of references without being able to find an error.

The biologist will find this book most useful, since not only the ovarian tumors in human beings and in the common laboratory animals are described, but also tumors in other species. Reference is made, for instance, to tumors found in the ovaries of goldfishes.

The first volume, which contains the text, as well as many photographs of microscopic sections, is looseleaf, since the publication of addenda is contemplated. The first volume also contains an excellent bibliography. The second volume, entirely devoted to bibliography, is casebound. The book is dedicated to the author's wife, the motion picture industry, and the New Yorker magazine, "without whose refreshing influence the boredom of this venture could not have been endured." Like the reviewer, the reader will feel that Mrs. Selye, the New Yorker, and Hollywood have each earned the undying gratitude of every scientist interested in this fascinating field.

WALTER FLEISCHMANN

THE ENDOCRINE GLANDS.

By Max A. Goldzieher. Rudolf Schick Publishing Company, New York. Charts: $6.25 ea.; booklet: $1.20 (paper). Five charts on linen, 27 inches by 41 inches, and explanatory booklet (ii + 49 pp.). 1945.

This set of 5 charts, together with an explanatory booklet of 49 pages, is an attempt to present the basic facts of endocrinology, both clinical and experimental. The illustrations are sufficiently clear to be of use in an elementary course on endocrinology. Unfortunately, however, few workers in the field will agree with many of the statements made in the explanatory booklet. In discussing pituitary dwarfism (p. 17), the author states that "injections of pituitary extract help these dwarfs to grow and to attain normal sexual maturity." Most endocrinologists feel that treat-

ment with pituitary extract is ineffectual in cases of true pituitary dwarfism (panhypopituitarism). The 17-ketosteroids are not the end-product of the breakdown of corticosterone as indicated on p. 34. The view that the daily output of 17-ketosteroids permits any conclusion as to cortical function is not in accordance with our knowledge of steroid excretion in various disorders affecting the adrenal cortex. The body build of the hypo-ovarian woman is described on p. 45 as characterized by very long upper and lower extremities. It is stated further that "castration at an early stage of life produces similar peculiarities of body build." This is in contradiction to the generally accepted fact that most women suffering from total absence of ovarian function (ovarian agenesis) are short and do not show the peculiarities of body build characteristic for the castrate woman.

The standard texts on experimental endocrinology consider the plumage of the male fowl as an independent sex character not under the influence of the gonads. This is certainly true for most breeds, such, for instance, as the Brown Leghorn. The male plumage of the Brown Leghorn capon has been used widely as an experimental test object for studies on the effects of the estrogen. On p. 48 of the booklet Goldzieher makes the startling statement that the capon shows female plumage. There are some discrepancies between the charts and booklet. The daily excretion for the normal adult male is given as "about 14 gamma" in the booklet and as 14 milligrams on the chart. Obviously only the latter figure is correct.

WALTER FLEISCHMANN

ANIMAL NUTRITION

ELEMENTS OF FOOD AND NUTRITION. *Second Edition. By Mary T. Dowd and Alberta Dent. John Wiley and Sons, New York; Chapman and Hall, London.* $2.25. xii + 357 pp.; 1 plate; 1 chart. 1945. This second edition has been completely revised and rewritten. The authors have attempted to bring it up to date both as to arrangement and subject matter, since, during the eight years that have elapsed between the two editions, there have been many new contributions and very significant changes in the field covered.

Following an introductory chapter on the "Relation of Nutrition to Health," there are four units, each containing several chapters. The first unit, Essentials for Good Nutrition, contains six chapters, dealing with (1) Energy Needs of the Body; (2) Requirements for Building and Repair—Proteins; (3) Requirements for Regulation—Minerals and Water; (4) Vitamin Requirements for Regulation and Protection, Vitamins A, D, E and K; (5) Vitamin Requirements for Regulation and Protection—Ascorbic Acid and B Complex Vitamins; and (6) How the Body Uses Food: Digestion and Metabolism. This unit is not complete, since it lacks a discussion of carbohydrates and fats. These are discussed in later chapters under the heading of Foods; but to make the first unit complete, it seems that they should be discussed there as essentials of good nutrition. In the discussion on digestion, the statement is made that the end product of carbohydrate digestion is glucose (alone), rather than a variety of the simple sugars.

The second unit, "Foods for Good Nutrition," includes chapters on: Nutritive Value of Foods; Milk and Milk Products; Fruits; Vegetables; Cereals and Cereal Products; Meat, Poultry and Fish; Eggs; Butter and Other Fats; Sugars and Sirups; and Beverages and Food Adjuncts. These chapters discuss the subject in regard to food values, cookery, storage, digestibility, and other pertinent factors.

The third unit is called "Planning for Good Nutrition," and contains the following chapters: Construction of Adequate Diets; Good Nutrition for Children; Meal Planning; and Buying and Preparing Food. This unit is quite complete in its discussion and has charts and pictures for illustration.

The fourth unit, on "Nutrition Fallacies," discusses Fads and Fallacies in Food and Nutrition adequately. At the end of each chapter in the book, there are Questions and Activities, and References, useful to the instructor. There is an appendix containing a table of the nutritive value of foods, and references to food and nutrition study. There is also an index.

This book has been written for the use of Senior high school students, or of adults without a scientific background. For this purpose it should be fairly satisfactory, except for the criticism of the first unit; for it is written simply and clearly, the topic of each paragraph being emphasized in heavy black print. The facts included are those which would be interesting and useful to those for whom the book was intended.

MARGUERITE M. SCHMIDT

NUTRITION AND CHEMICAL GROWTH IN CHILDHOOD. *Volume II: Original Data. By Icie G. Macy. With a foreword by Lawrence Reynolds and a supplement by Julia Outhouse Holmes. Charles C. Thomas, Springfield, Illinois.* $10.00. Pp. xxv-xlii; 433–1460. 1946.

The publication of "all the facts" that have been observed in the extensive study of the many body processes of a group of children of different ages over a long period, and some of the details of physiological occurrences at various age levels in the lives of normal children, is a most remarkable contribution to the literature of nutrition. The original intention of the author, as stated in the preface of Volume I, was

that Volume I would be an evaluation and Volume II an interpretation of the data of this magnificent study. However, the preface to Volume II states that "as work proceeded on the second volume it became apparent that a single tome could not include all of the data and a full interpretation of the original results." Therefore it was decided to present "all the facts," and to leave to Volume III the interpretation based upon the data and the calculations. The work was done under The Children's Fund of Michigan.

The table of contents lists the contents of Volume I, as well as of Volume II. There is a brief Introduction, which gives some of the details of the study and includes tables of analyses of individual foods, vitamin C content of foods, and weather data for time of studies. There follow the complete data collected on each child in the three studies. All of the data on any one child is put under the child's name. These data include, among other things: anthropometric measurements; food intake studies; blood determinations on various constituents; recumbent length and weight; basal metabolism measurements; roentgenograms of hands, jaws, teeth, bones, and progress of barium meals through the G. I. tract; nitrogen intake and output; mineral intake and output; etc.

This second Volume also includes a supplement by Julia Outhouse Holmes, containing the data collected from a study made at the University of Illinois of the mineral metabolism of twelve normal, healthy boys and girls of pre-school age. Besides a discussion of the procedure and methods used, roentgenograms of the hands of the children are reproduced.

Addenda to the volume contain data on children with osteopsathyrosis, ununited fracture, and lipemia. There are also the results of hematochemical studies of the blood in health and disease, and values for blood studies on a patient with epilepsy. A cumulative index for both volumes is provided.

The value of this book to research workers in the field of nutrition and chemical growth in childhood would appear to be limitless; for here, in one volume, are all the data collected in this most comprehensive study.

MARGUERITE M. SCHMIDT

THE VITAMINS IN MEDICINE. *Second Edition, Revised and Enlarged.*

By Franklin Bicknell and Frederick Prescott. Grune and Stratton, New York. $12.00. xii + 916 pp. + 1 table. 1946.

Bicknell and Prescott's book, first published in 1942, and now enlarged and revised, represents the most successful attempt in any language to cover this enormous field. One is impressed, first, by its appearance at all under the conditions which heralded its birth, and, second, by the fact that the text is eminently readable in spite of the forty-five hundred references to original literature embodied therein. Although papers on vitamins multiply at a great rate, the authors have kept this volume up to date to 1944, and deficiencies now apparent in the text must be regarded as but the virtues of an active field.

Confronted on the one hand with reports of vague and tenuous interrelationships of vitamins with diseases, and on the other with downright contradictions in testimony, the reader is apt to demand a statement of reasonable probability, free of dogmatic assertion; this, it seems, has been provided by the authors, to a very great degree. Only occasionally may exception be taken, e.g., to the summary dismissal of evidence from paired feeding experiments (p. 793), when such appear to be the only way in which the presence or absence of specific factors affecting the efficiency of conversion of foodstuffs can be gained. Comparing the older with the new edition, one notices that trigonelline has been deftly demoted from the nicotinic acid trinity. The number of illustrations has been substantially increased—although in passing it may be observed that pictures of vitamin crystals would seem to possess little intrinsic interest. A number of plates (pp. 398, 418, 527, to mention a few) cry aloud for representation in color, an art apparently freely available to the glossy brochures of the vitamin vendors, but denied to texts intended for the instruction of those whose business is the diagnosis of deficiencies.

This book may be confidently recommended to the medical practitioner and nutritionist, while numerous references to problems involved in fortifying a wartime dietary substantially widen its scope of appeal.

H. R. CATCHPOLE

CHEMISTRY OF FOOD AND NUTRITION. *Seventh Edition. By Henry C. Sherman. The Macmillan Company, New York.* $3.75. viii + 675 pp. 1946.

Sherman has again published an up-to-date textbook for use in college class rooms. This seventh edition (6th edition reviewed QRB 16: 506. 1941) is an excellent text, complete in its information, clearly written and well arranged, making it useful for many purposes. As stated in the preface, "for the convenience of shorter courses, such parts of the text as can be omitted while still preserving a continuity of presentation are set in smaller type; while for a longer and more critical course, ample reading lists are appended for the individual chapters."

The order and titles of the first twenty-eight chapters are the same as in the sixth edition. At that point there have been inserted two new chapters entitled "Nutritional Characteristics of the Chief Groups of Food" and "Causes and Extent of Variations in

the Nutritive Value of Foods." These are then followed by the two concluding chapters bearing the same titles as in the sixth edition. While the titles of the chapters remain the same, the text has been revised in many places and entirely rewritten in others, to include more recent information. Charts and tables are used to clarify the information contained in the chapters, but few pictures are used. The number of references to original literature and to other books has been increased so as to give adequate material for further study.

There are the same five excellent appendices at the end of the book as in the previous edition, with only a slight revision of the descriptive material that introduces the tables. These tables summarize: Factors for Calorific Values; Protein, Fat, Carbohydrate and Energy Values of the Edible Portions of Foods; Mineral Elements in Food; Parts per million of Copper and Manganese in the Edible Portion of Foods; and Statistical Treatment of Data and Nutrition Investigations. A subject index concludes the book.

This book is a most worthwhile text, to be highly recommended.

MARGUERITE M. SCHMIDT

BIOCHEMISTRY

MEDICAL BIOCHEMISTRY. *Second Edition.* *By Mark R. Everett. Paul B. Hoeber, Medical Book Department of Harper & Brothers, New York and London.* $7.00. xiv + 767 pp. 1946.

Everett has prepared a revised edition of his textbook, which was well received on its first appearance in 1942. The special merit of the text as a compendium of biochemical and clinical material, correlated for medical practitioners and students, is again evident. New topics are: adaptive enzymes, amino acid therapy, antibiotics, cephalin fractions, cirrhosis, dicumarol, gangliosides, phosphorylation, Rh factor, and thiouracil.

There is evidence on every hand of the author's remarkable industry and thoroughness. Thus one finds throughout the book numerous unique and interesting tables. To mention only a few, there are tables of approximate dissociation constants for some 150 important metabolites, ranging from acetoacetic acid to xanthine, of the approximate pH of tissues and body fluids, of the effect of various foods on the acid-base relation of the body, and of pneumococcal polysaccharides. In this connection the author's zeal has also led him to include some tables of debatable value, such as one on the iodine number of lipides.

Despite the great range of subject matter, nearly all phases of biochemistry are given good factual treatment. It is inevitable that a few isolated instances of confusion creep in here and there. Thus, on p. 90, we are told that enzymic adaptation may be likened to the Pasteur Effect, a rather unfortunate use of the term. Such slips are minor, however, and in no way detract from the book as a whole.

The author has stated his desire to write "a text which includes essential facts and data fundamental to a basic medical education, eliminates pros and cons, and is of such size the student will have time to read it." Few biochemists would attempt such a task. Indeed, to do so would be impossible in the present state of the science. Here the presentation of factual material has been accomplished admirably. However, the book is of formidable size as a result. Pros and cons are a prominent feature of every science, and not least so of present-day biochemistry. It is not clear that their elimination clarifies matters for the student. The practising teacher must fill in the pros and cons while using textbooks for the factual scaffolding. In this sense, Everett's book is among the best available.

This edition has been printed handsomely on a fine grade of rag stock. The print, while small, is clear and easily readable.

MARTIN D. KAMEN

A TEXTBOOK OF BIOCHEMISTRY. *By Philip H. Mitchell. McGraw-Hill Book Company, New York and London.* $5.00. xvi + 640 pp. 1946.

This is a conventional text in biochemistry. Twenty-one chapters and some six hundred pages are given over to a conservative presentation of various aspects of biochemistry at the elementary level. The major difference between this text and others available is that here emphasis is placed on the nutritional phases of the subject. This results in a somewhat unbalanced exposition, certain subjects having been slighted to the advantage of others. It does not appear that this book is in any way an improvement on the bulk of texts available.

The major weakness of the book is that it has embalmed much material which is out of date. Thus, in the chapter on photosynthesis, we read (p. 51) that "the reduction of 1 gram molecule of CO_2 in photosynthesis in red light appears to require four quanta per molecule." The ghost of this four-quantum yield was laid at least ten years ago by Daniels, Emerson, and others. The entire chapter is based on theories and material long since outmoded, so that it appears that the author has not consulted the literature of the last ten years on photosynthesis. More surprisingly, he has included at least one reference at the end of the chapter in which there is a modern treatment of the subject that critically disposes of much of the material he has given in this text. In general, it is difficult to see how the

publishers' claim that a "modernized" treatment is presented can be substantiated.

The format and binding of the book are good; the style is clear. A convenient introduction to biochemical literature is included.

MARTIN D. KAMEN

EXPOSÉS ANNUELS DE BIOCHIMIE MÉDICALE. *Cinquième Série.*

By H. Bénard, A. Boivin, P. Boulanger, J. Cheymol, M. Jayle, M. Macheboeuf, M. Polonovsky and A. Gajdos, J. Roche and Y. Derrien, Ch. Sannié, and J. Tréfouël. Masson et Cie., Paris. 500 fr. (paper). 301 pp. 1945.

This volume includes ten reviews of biochemical subjects: Données biochimiques récentes dans la domaine de la fécondation, de la sexualité et de la génétique, by by P. Boulanger; Les protéines du plasma et du sérum, by Jean Roche and Yves Derrien; Les cénapses lipidoprotéidiques, by Michel Macheboeuf; La vitesse de sédimentation globulaire, by Max-Fernand Jayle; Les mélanines, by Ch. Sannie; De l'hémoglobine à la bilirubine et à l'urobiline, by Michel Polonowski and Alfred Gajdos; Le métabolisme azoté des bactéries, by A. Boivin; Action biochimique de l'insuline, by H. Bénard; Sulfamides et antisulfamides, by G. Tréfouël; and Histamine, Antihistaminiques, by J. Cheymol. The quality of these reviews is very unequal; at least that by Boulanger is not very critical. Coverage of the literature, other than the French and German, understandably stops with 1940 or 1941. The important work done by French workers on antihistamine substances should make the final review of particular interest.

ADVANCES IN ENZYMOLOGY *and Related Subjects of Biochemistry. Volume V.*

Edited by F. F. Nord and C. H. Werkman. Interscience Publishers, New York. $5.50. vii + 268 pp. 1945.

The fifth volume of recent advances is slimmer both in quantity and in quality than its predecessors. However, biologists will find several articles here to aid them in their attempts to assimilate the recent results of their biochemical colleagues.

In an excellent chapter, Pirie has summarized our knowledge of the physical and chemical properties of tomato bushy stunt virus and of various strains of the tobacco mosaic virus. This author possesses a well-defined point of view and thus avoids the irritating habit, which has become quite common among recent reviewers, of placing equal weight on all the results reported. No virus preparation has been obtained in which it could be sure that every constituent particle was an infectious agent. Despite this, it is clear that in large part the properties of these preparations may be referred to those of the infective particles. The results of the various investigations described here have provided us with a surprisingly large body of accepted knowledge of the tobacco mosaic group of viruses, knowledge comparing in extent quite favorably with the information available on most other proteins. Dealing as it does with the physical and chemical characteristics of self-duplicating units, this knowledge will be of undoubted interest and usefulness to biologists.

A careful and critical consideration of the chemistry and enzymology of the factors controlling clotting will be found in Chargaff's article on "The Coagulation of Blood." A heroic attempt has been made to clear up some of the terminological confusions which have beset this field. The author has wisely avoided adding to the multiplicity of theories which have been proposed for explaining the clotting phenomenon.

Although such physiologically important compounds as histamine and adrenaline are amines, comparatively little is known about the synthesis of this group in animal tissues. Only recently has a satisfactory proof been offered for the formation of an amine in an animal body. Blaschko has gathered together the scattered information which has accumulated on amine-forming enzymes (amino acid decarboxylases) in mammalian tissue.

Liebowitz and Hestrin discuss their own important contributions, as well as those of other authors, to the problem of the mechanism of the fermentation of the oligosaccharides. This problem gains much in interest from the fact that in nature the carbohydrate substrates occur mainly in the form of disaccharides rather than as the simple hexoses which have caught and held the major attention of biochemists. The recent discovery of the phosphorylytic cleavage of the disaccharides has permitted these authors to propose a rational resolution of the now historical argument concerning the 'direct' versus the 'indirect' fermentation of the disaccharides. Pyruvate metabolism is discussed by Stotz. Since pyruvic acid occupies a key position in carbohydrate metabolism, it is inevitable that this review repeats much of the material covered by the reviews in the preceding volume.

Nord and Mull have summarized the work done in the latter's laboratory on the biochemistry of Fusaria over the past eight years. It is evident that much remains to be done before the metabolism of this group will be clear. It is unfortunate that so much effort has been expended in this review on polemics against the phosphorylative glycolytic mechanism. Even if all the details of carbohydrate metabolism in Fusaria were known and if the mechanism turned out to be conclusively a non-phosphorylative one, it is still obvious that this would not constitute disproof of the accepted pathway of carbohydrate metabolism in yeast and muscle. One might as well try to deny the existence of aerobic metabolism by

offering as proof the existence of obligate anaerobes. These authors should recognize that their investigations with the biochemistry of Fusaria have an intrinsic interest of their own. They gain little by adopting an attitude in discussing their data which forces the reader to compare the meagerness of their evidence against the phosphorylative mechanism with the massive amount of data which is consistent with it.

Schlenck privides a timely and useful summary of the enzymatic reactions involving nicotinamide and its related compounds. Smythe concludes the volume with a brief account of enzyme reactions on sulfur compounds, from which it is evident that this field was not as yet in a position to support a review of advances.

S. SPIEGELMAN

DIE NEUERE ENTWICKLUNG DER KOLLOIDCHEMIE DER STÄRKE. *Handbuch der Kolloidwissenschaft in Einzeldarstellungen, Band VIII.*

By M. Samec, with the collaboration of M. Blinc. Theodor Steinkopff, Dresden and Leipzig; [Edwards Brothers, Ann Arbor, Michigan]. $10.00. xvi + 543 pp. 1941; [1946].

In this book the authors have successfully summarized the extensive work on the chemistry of starch up to the year of 1941. They have effectively compiled the voluminous literature in this field; however, owing to the many noteworthy developments since 1941, this book is unfortunately already out of date. Among the more recent contributions not included are: (a) separation of whole starch into two components, having different chemical structures; (b) the constitution of synthetic polysaccharides and their relation to natural starches; and (c) the nature of the starch iodine complex.

In some cases the authors emphasize erroneous and discarded ideas, as, for example on page 22, where they state that phosphorus in starch is considered as having an important role in plant metabolism. On page 67, there is reiterated Taylor and Sherman's belief that fatty acids (palmitic, oleic, and linolic) are esterified with starch. Actually, Schoch recently showed that fatty acids in starch are adsorbed impurities and can be removed from corn, rice, and wheat starches without hydrolytic degradation by extracting with methanol or 80 per cent dioxane. This book, therefore, is inadequate as a source for those seeking up-to-date information about the chemistry of starch.

Nevertheless, the book is useful for its tables and graphs, which present an enormous amount of data in summary form. There is also a great deal of valuable information regarding experimental techniques such as acetylation, methylation, and viscosimetric and osmotic pressure measurements, employed by various investigators. It is also worth mentioning that the book contains a good outline of Myrbäck's work on starch, originally published in Swedish. For these reasons it should prove to be a useful handbook for research workers in the field of starch chemistry.

W. Z. HASSID

TASCHENBÜCH FUR DIE LEBENSMITTELCHEMIE. *Hilfstabellen für die Arbeiten des Chemikers, Lebensmittelchemikers, Gärungschemikers, Fettchemikers, Wasserchemikers und verwandter Berufe.*

By A. Thiel, R. Strohecker, and H. Patzsch. (Walter de Gruyter & Company, Berlin); J. W. Edwards, Ann Arbor, Michigan. $3.20. xi + 173 pp. + 4 tables. (1938); 1945.

This pocket-sized handbook contains 66 tables useful in the analysis of milk, water, alcohol, sugars, wine, fats and oils, and in general analytical work. The tables giving the determination of the content of sulfuric, hydrochloric, nitric, phosphoric, formic, and acetic acids, of potassium and sodium hydroxides, of ammonia, methyl alcohol, and glycerin from the density of aqueous solutions, and the table of equivalent weights of many substances, with their logarithms, should be great conveniences in the laboratory.

MICROBIOLOGY

BACTÉRIES ET VIRUS. *La Science Vivante: Collection Dirigée par René Audubert.*

By André Boivin. Presses Universitaires de France, Paris. 35 frs. (paper). 146 pp. 1941.

This excellent brochure—the first of a new French series on science for the non-professional reader—can hardly be called a popular book in the sense familiar to the American reader. Its technical language may be within reach of the average holder of a "Baccalauréat-ès-sciences," but it is certainly not easily understandable by a great many American college graduates. Moreover, its restrained approach to the subject matter presupposes more sophistication and capacity of abstraction than are usually required of the mildly interested, non-professionally trained reader of popular science books. It is unusual, and rather pleasing, not to find in such a book either a comparison of the size of bacteria with that of mice, nor of their activities with those of a chemical factory. Even when discussing medical or industrial applications, the author seems to feel that his subject matter deserves interest and dignified approach in itself rather than through reminders of its practical aspects.

The plan of the book is that of a broad survey, with separate sections on bacteria as free-living organisms, on the activities involved in their parasitic life, and on filterable viruses and their position at the elusive border

where "life" begins. Few of the classic bacteriological problems are left untouched. Remarkably successful for a book of this scope is the concise treatment of topics such as immunology, the energetics of bacterial metabolism, and the nature of viruses.

In spite of a number of obscurities, partly due to overambitious attempts at completeness, the book provides an excellent survey of bacteriological problems for the reader with adequate training in chemistry and little time for more voluminous sources.

S. E. LURIA

A TEXTBOOK OF BACTERIOLOGY AND IMMUNOLOGY. *By Joseph M. Dougherty and Anthony J. Lamberti. The C. V. Mosby Company, St. Louis.* $4.50. 360 pp. 1946.

Designed as an introductory text to medical bacteriology and immunology, this book is presumably for students who have had no previous experience in bacteriology. It is comparatively short, and the material has been purposely simplified. The opening chapters are historical and technical—dealing with laboratory equipment and methods. The next part of the book is concerned with immunity and infection and with serological reactions.

The various groups of pathogens are then discussed. Details of diagnostic laboratory procedures are kept to a minimum. In connection with spirochetes, chemotherapy and antibiotics are considered. A rather remarkable omission, from a public health standpoint, is that of the *Hemophilus* group, particularly because of the etiology of whooping cough. The presentation of virus diseases is probably adequate for the diseases covered, but measles might have been included.

The text closes with chapters on the bacteriology of water and foods and on parasitic protozoa. In both there is some information on procedures.

HARRIETTE VERA

GENERAL BACTERIOLOGY LABORATORY MANUAL. *By L. S. McClung. W. B. Saunders Company, Philadelphia and London.* $1.25 (paper). ix + 106 pp. 1946.

From the University of Indiana comes a new manual for students in general bacteriology. It consists of 61 short exercises, each one or two pages in length. For each exercise there is an opening explanatory statement, a list of required materials and a procedure, the steps of which are clearly stated. Space is allotted for recording data, with appropriate rulings for charts or with circles printed for the insertion of drawings. The subjects of the exercises are limited in scope, and several could probably be undertaken in one laboratory period, depending upon schedule arrangements. About a fourth of the topics are concerned with morphology or staining techniques, another fourth with biochemical reactions, ten with environmental influences, five with immunological procedures and with bacteriophage, and the remainder with additional methods, a study of the growth curve, and other matters. In four appendices there is information about the microscope, media, reagents, and miscellaneous laboratory requirements.

The directions are simple, brief, and concise and should be intelligible to almost any student. For teachers, such a work book should be particularly useful for handling large classes and should facilitate the problem of correcting reports.

HARRIETTE VERA

HEALTH AND DISEASE

THEORY OF LIFE, DISEASE AND DEATH. *By Morton Whitby. Cutler Publishing Company, Chicago.* $5.00. 275 pp. 1945.

This little volume by a Harley Street urologist extols the value of Ellis's Micro-Dynameter in the localization and diagnosis of disease. By means of electrodes placed upon the skin, this supersensitive galvanometer measures the "dynamic current," "oxygenation current," "potential energy," "polarization," "acid/alkaline balance," and "skin current" of the human body. In the author's opinion, the apparatus "will indicate the patient's state of health in terms of electrical energy, whether the patient is in robust health, fair health, poor health, or in danger of death." In addition, "readings over the head or the spinal processes of the spinal column are of the first importance, since they indicate the exact nerves which are affected; and with an up-to-date knowledge of the sympathetic, motor, and sensory nervous systems, one is able to tell roughly which organs are affected."

"Dynamic therapy" is given to make up deficiencies in dynamic current and potential energy, at least temporarily. Three groups of cases are reported: eleven "Cases of Disease" (including uremia, empyema, and retrosternal goitre), eleven "Cancer Cases," and two "Cases of Surgical Shock."

Using these methods as a scientific springboard, the author proceeds to distill the most amazing generalities concerning life, death, and disease, while offering hardly a vestige of experimental proof. Two examples of his theories will suffice: "It is my opinion that the difference between a living and a dead organism is the existence or non-existence of dynamic current, and non-existence is due to complete polarization." "Cancer is the result of complete obstruction to local lymphatic drainage, with a consequent abnormal bio-chemical state, which leads to an insidious unchecked prolification of cellular growth.—I believe all cases of cancer suffer from lym-

phatic sclerosis, which I term lymph-sclerosis. This lymph-sclerosis is usually associated in subjects of arterio-sclerosis, or subjects who have hereditary lymphatic narrowing."

Granted that there is still much to learn about the electrical reactions of the body, this book, in the reviewer's opinion, is not the place to learn it.

CAROLINE B. THOMAS

DEVILS, DRUGS AND DOCTORS: *The Story of the Science of Healing from Medicine-Man to Doctor.*

By Howard W. Haggard. Pocket Books, New York. 25 cents (paper). xx + 427 pp. 1946.

Seventeen years have been quite enough to demonstrate the popularity and lasting power of Haggard's breezy history of medicine, first reviewed in this journal in 1930 (Q.R.B. 5: 119). Its faults are as noticeable as ever, but despite them it is one of the better popularizations of science. Its availability in a 25-cent pocket edition to great numbers of new readers will be welcomed by biologists. The publishers have done a fine service by including it on their list. May one hope that it will sell at least as well as the run of the current crop of detective stories?

ASCLEPIUS: *A Collection and Interpretation of the Testimonies. Publications of the Institute of the History of Medicine, the Johns Hopkins University. Second Series: Texts and Documents. Two Volumes.*

By Emma J. Edelstein and Ludwig Edelstein. The Johns Hopkins Press, Baltimore. $7.50. I: xviii + 470 pp.; II: x + 277 pp. 1945.

In the first volume of this pair the authors have collected all the written evidence from antiquity concerning Asclepios and his cult. The passages are given both in the original and in translation. This "sourcebook" on Asclepios makes interesting reading in itself, and is technically an invaluable space-saver for the second interpretative volume, where even so the footnotes have an annoying tendency towards malignant growth.

In the second volume the authors reconstruct the history of Asclepios from the available sources. Originally a legendary physician from Thessaly, a hero symbolizing medicine, and the patron of physicans ("Asclepiads"), Asclepios became a god at the end of the 6th century B. C. From Epidaurus his cult spread all over the ancient world, and the god, to whom Socrates in his last moments vowed a cock, proved to be a most dangerous competitor to Christianity, his worship holding out well-nigh into the sixth century of our era.

The authors analyse all technical and ideological aspects of the Asclepios cult: its ritual, temples, images, etc. Most interesting from the point of view of medical history are, of course, the miracles through which the god healed his worshippers. The authors show how the dreams accompanying the miracles reflected secular medical practice. They refute the obstinate legend that the priests of Asclepios were physicians, or the temples sanatoria. They rightly emphasize the social aspects of the Asclepios cult, which provided cure to those strata of ancient society which could not afford ordinary medical care.

Once one has overcome the difficulties which the traditional methods of philological writing create for a non-specialist reader, admiration of the erudition of the authors grows into real fascination with a most interesting chapter in human history and into thorough enjoyment of a masterly exposition.

ERWIN H. ACKERKNECHT

CLASSIC DESCRIPTIONS OF DISEASE *With Biographical Sketches of the Authors. Third Edition.*

By Ralph H. Major. Charles C. Thomas, Springfield, Illinois. $6.50. xxxii + 679 pp. 1945.

To those who have not yet come across Major's *Classic Descriptions of Disease*, which first appeared in 1932, it might be briefly explained that this source book comprises 286 passages taken from medical literature ranging in time from the papyrus Ebers to Froehlich, Banting, Buerger, and other contemporaries. The pieces collected are either the first known, or among the earliest, or one of the most interesting accounts of particular diseases. Many of them are translations, and good translations, too. The ten subdivisions of the book are: infectious diseases; diseases of metabolism; lead poisoning; diseases of the circulatory system; diseases of the blood; kidney diseases; respiratory diseases; deficiency; allergic diseases; and diseases of the digestive tract. Excellent biographic sketches are interspersed, and 185 valuable illustrations increase the attractiveness of the volume.

I cannot think of any other book more likely to endear medical history to the average medical man or scientist. While preoccupation with dead medical or biological theories presupposes a certain amount of historical background which our schools no longer give, good clinical descriptions have a perennial value and an immediate appeal and charm. They are more intelligible to the busy and non-instructed than any textbook of medical history. They create a respect, an understanding, and an interest for the past, which are likely to bear fruit in further and more intensive studies.

Ralph Major has done a superb job in selecting, commenting upon, and illustrating his material. The third edition contains 46 additional pieces as compared

to the first edition, and many improvements in the comments and illustrations. The necessity to keep the volume about the same size has made necessary the use of smaller-sized type for the selections, esthetically a little less satisfactory than the old arrangement, but no serious handicap in readability. Bibliography and index complete a book that is highly recommended to all those who have missed so far the pleasure of its acquaintance.

ERWIN H. ACKERKNECHT

EVOLUTION OF PLASTIC SURGERY.

By Maxwell Maltz. Froben Press, New York. $5.00. xiv + 368 pp. + 1 plate. 1946.

Maltz, a busy practitioner in the field of plastic surgery, lists surgical authors and their accomplishments from the Ebers papyrus and Susruta down to our own days, liberally describing a number of his own techniques. A large part of the book deals with methods of wound treatment. There is no bibliography; nowhere are there any references to indicate where the author picked up his material or found his numerous translations. Many of the data (mistakes included) are very obviously second hand, and well known. In spite of these faults, the subject and many of the data are very interesting, and the author is able to write well, particularly when he does not try too hard to be funny. There is a wealth of fine illustrations, though too often without any connection with the text. I have unfortunately seen worse books than this one in the field of medico-historical dilettantism. Still, the book is so unreliable and confused that I could not recommend it to anybody. It is in character with the rest of the book that annoying printer's errors are abundant.

ERWIN H. ACKERKNECHT

GENERAL AND PLASTIC SURGERY *with Emphasis on War Injuries.*

By J. Eastman Sheehan. Paul B. Hoeber, Medical Book Department of Harper and Brothers, New York and London. $6.75. x + 345 pp.; 1 plate. 1945.

Plastic surgery has always been the most imaginative and inspiring field for surgical skill. Indeed, it is one of the few creative spheres of modern science, flowering almost alone in the climate of our contemporary disasters. Of course, such disasters have been of some use to the physician. World Wars I and II—plus a few civil wars and minor catastrophes—have been important milestones in the career of an outstanding plastic surgeon like J. Eastman Sheehan. This is made quite clear in his new book, which must be exciting reading even for the layman who has an intelligent interest in medicine. Nearly a thousand remarkable illustrations illuminate the description of almost every operative technique today recognized in plastic surgery. The subjects of excision, infection, anesthesia, infusions, tissue replacements, forms of skin graft, burns and blasts, bone replacements, scars, and prosthesis are fully presented.

No doubt, as indicated above, the experiences of modern warfare have greatly advanced our civilian medical standards. But the reader of this book cannot help hoping that our contemporary plastic surgeons will have no further opportunity to expand their skill as a result of future and more terrible destruction of the human body.

MARTIN GUMPERT

THE POPULAR MEDICAL ENCYCLOPEDIA: *The Standard Guide on Health and Disease.*

By Morris Fishbein. Doubleday & Company, Garden City, New York. $4.95. i + 540 pp. 1946.

Morris Fishbein has assembled in this encyclopedia a large amount of material that is likely to be of interest to the lay reader intent upon enlarging his knowledge of medical information. This collection not only appears to be quite complete, but so accurately and simply presented that the book should satisfy the demands of the general public quite adequately. The chief weakness of the text is the relative paucity of illustrations, considering the variety of unfamiliar subjects that it contains. This, however, should not be regarded as any great detriment to an otherwise excellent work.

JOHN E. CUSHING

QUARTERLY REVIEW OF PEDIATRICS, *Volume 1, Number 1, February 1946.*

Edited by Irving J. Wolman. Published by Washington Institute of Medicine, 1720 M Street, N.W., Washington 6, D. C. Annual subscription: $9.00.

The primary function of this new journal is to collect and abstract in readable form the voluminous current literature in the field of pediatrics. The journal will aim at accuracy and prompt coverage, with a certain amount of critical analysis. The 160 abstracts appearing in the first issue are grouped into 34 categories, for each of which additional references to current articles are listed. There is a section of brief unsigned book reviews, and the issue also includes comprehensive subject and author indexes. The new review journal will assuredly be of great value not only to pediatricians proper, but to many workers in such fields as allergy, hematology, chemotherapy, endocrinology, public health, parasitology, nutrition, and human physiology.

SKIN DISEASES, NUTRITION AND METABOLISM.

By Erich Urbach, with the collaboration of Edward B. LeWinn. Grune & Stratton, New York. $10.00. xxii + 634 pp.; illus. 1946.

This book is divided into five parts: biochemistry of the skin; diseases of the skin due to malnutrition (including avitaminoses and food allergies); the influence of diseases of the digestive apparatus on the skin; dietary therapeutics; and nutritional tables.

The metabolism and biochemistry of the skin, described in the first part in relationship to diseases of the skin, is a relatively unexplored field. The author's work in this field, utilizing microchemical methods on his unique punch biopsy specimens of living skin, stands alone. His concept of "skin diabetes" based on this work is a contribution which has occasioned wide comment and interest. The interpretation of much of the vast material herein reported, however, is controversial, and still remains to be clarified.

Among the many nutritional deficiency states causing dermatoses discussed by the author, he includes low-protein edema, carotinemia, pellagra, the role of vitamin B in seborrheic eczema, of vitamin K in purpura, together with a review of the experimental work on animals. Seventy-three pages are devoted to food allergy as a cause of skin diseases. Although this treatise, as well as many others, makes a convincing case for food as a sensitizer and cause of many obscure dermatoses, the conclusions drawn are based upon too few case reports, often uncontrolled or unconfirmed, to be accepted in their entirety.

The third division of the book contains in one part an interesting discussion of eruptions due to poisons or infection-bearing food taken into the digestive tract, and of eruptions associated with diseases of the digestive system in another. Autointoxication, due to so-called intestinal putrefaction and fermentation, receives due attention, but is placed on no sounder a scientific basis than in prior publications.

Nutritional therapy of skin diseases, treated in the fourth part, takes up 159 pages. By dietary regulation it is contended that widely divergent dermatological entities, such as, for example, eczema, Darier's disease, acne, and tuberculosis, can be cured or ameliorated.

Sample diets for every dermatological disease, where indicated, and nutritive food values may be found both in the substance of the book and in the 112 tables at the end. The bibliography is very complete.

H. HANFORD HOPKINS

COSMETICS AND DERMATITIS.

By Louis Schwartz and Samuel M. Peck. Paul B. Hoeber, New York and London. $4.00. x + 189 pp. + 13 plates. 1946.

This is a small book, consisting of 189 well-printed pages. The illustrations, with the exception of the frontispiece, are poor. The first 37 pages are taken up by a review of the anatomy and physiology of the skin. The remaining pages contain a classified discussion of cosmetics, attention being paid to details of manufacture, chemical composition, and human usage, in particular relationship to the development of dermatitis by users. The distinction between primary irritants and allergens is pointed out. The book is both interesting and useful to the dermatologist, and would be still more so had the authors been able to list trade-name examples of the cosmetics discussed. However, the reader may find this lack supplied by using the references, which are extensive.

H. HANFORD HOPKINS

KNOW YOUR PROSTATE. *The Dangerous Age of Man. By Edwin F. Bowers. Knickerbocker Publishing Company, New York.* $2.00. 152 pp. 1945.

"Away back in 1916," says the author, "I published a book—'Alcohol—Its Influence on Mind and Body'—which may be found covered with dust and mildew—in some of the old library shelves." (p. 122).

This statement regarding an earlier publication appears to be quite prophetic of the fate of the present work. A tremendous amount of research has obviously gone into the compilation of this volume—research consisting almost entirely of collecting, rehashing, and directly quoting (in many cases without any mention of the original source) of myriads of newspaper and magazine articles, of which many are of the "it was learned here today" type!

The work is clearly intended for the lay rather than the professional reader. Even so, there is not much here about the prostate that is not to be found in a senior high school course in biology. After a few brief paragraphs on the general anatomy and physiology of the prostate, the reader is led through the entire endocrine system, ionization, foods and diets, sleep and rest, and finally into what appears to be heart of the work, a bungling attempt to debunk present-day tobacco and whiskey ads. An attack on the "weed" and "demon rum" by way of the prostate is at least something new in the annals of literature, even though the result is bizarre and far-fetched. One is surprised to find that such an ardent extoller of the evils of tobacco and alcohol as the author seems to be has apparently never heard of the late Raymond Pearl's classic researches into the effects of smoking and drinking on human longevity.

At many points throughout the text, the reader, whether lay or professional, will be irritated by bad grammar, faulty sentence structure, misspelling, forced humor, needless repetition, and statistics that have been quoted without mention of the original source of information. Several statements which are sufficiently revealing follow:

"Remember that when you rest you rust." (p. 33).

"... approximately 80 percent of men have had gonorrhea at some time in their life." (p. 43).

The complete sentence: "Or else a sitz bath for 10 or 15 minutes, two or three minutes, two or three times daily." (p. 85).

The "sensative prostate." (p. 121).

In Chapter VIII, "The Beginning of Old Age," there are at least six paragraphs that are repeated word for word from Chapter II, entitled "Men Also Have Change of Life."

By far the most interesting part of the book is the cover jacket, on the back of which is advertised "The Pin-Up Book of the Year," entitled "The Bedside Tales" [something for every bedtime mood and need (well almost)] with an introduction by Peter Arno, and sections devoted to "Humor," "Women," "Great Literature," and "Chills, Dreads and Terrors." Anyone planning to obtain a copy of "Know Your Prostate" is advised to change his order to "The Bedside Tales."

B. AUBREY SCHNEIDER

WHAT YOU CAN DO FOR ANGINA PECTORIS AND CORONARY OCCLUSION.

By Peter J. Steincrohn. Doubleday and Company, Garden City, New York. $2.50. 254 pp. 1946.

Hardly had I received this volume for review when I suffered an attack of coronary occlusion myself. A more interested reader could hardly be imagined: the book seemed written for the special occasion.

Steincrohn handles his rather depressing subject with skill, with serenity, with humane understanding, and every intelligent cardiac patient will benefit from his expert advice. Moreover, relatives, friends, and associates of cardiacs can acquire from it vital and perhaps life-saving knowledge. Among the average popular medical books this one stands out for its clarity, its straightforwardness, and its decision not to avoid unpleasant facts. It can therefore fulfil a really useful purpose, particularly since angina pectoris and coronary occlusion are steadily advancing into the forefront of pathological conditions and of causes of death. In 1938, 48 per cent of our population over the age of ten died from vascular disease, and only 16 per cent from infectious diseases and 13 per cent from cancer.

Steincrohn gives clear and sensible answers to a great number of practical problems which arise for the cardiac patient, such as, May I drive a car? What about tobacco? Alcohol? Sleep? Coffee? Exercise? Bathing? Climate? Yet two of the most important questions of all are overlooked, or almost overlooked. First, how should the sufferer from coronary disease regulate his sex life? Second, how can he manage his condition if he is not a rich man, but either poor or a small wage-earner without substantial savings? To enable a cardiac patient to behave as he should, cash is needed, and quite a lot of it. But to solve these basic problems is probably too much to ask, and Steincrohn's book is an important contribution to popular medical literature.

MARTIN GUMPERT

TREATMENT OF ARTHRITIS AND RHEUMATISM IN GENERAL PRACTICE, *Particularly in Women. A Different Approach to the Problem.*

By Bernard Aschner. Froben Press, New York. $5.00. xvi + 340 pp. 1946.

When medicine became scientific, it did away with most of the therapeutic methods which it was unable to explain. It seems beyond doubt that a number of these "empirical" methods were of actual value in at least some of their applications, and practical medicine thus suffered a definite loss. It is interesting to remember that Virchow, one of the great promotors of scientific medicine, warned against giving up empirical methods of healing. It seems also beyond doubt that reading the ancient medical authors, who were by no means less intelligent than our contemporaries, repays not only in the way of satisfying intellectual curiosity, but sometimes in a very practical way. It is time to raise the voice against the scientific snob who is no longer able to diagnose anything without machines and laboratories, and who often has little more to offer for therapeutics than costly and little effective procedures.

It is therefore understandable that we sympathize with Aschner's revival, in a field like arthritis, where scientific medicine has as yet little to offer, of such empiric, common-sense methods as reducing, sweating, purging, and even blistering. Being convinced of the correctness of Aschner's observations of the connection between arthritis and menopause, one must regret that his one sided way of exposition is only apt to discredit his approach. Simply taking the ancients at face value, practical methods and hazy theories alike, shows his complete lack of historical perspective, just as his adoption of therapeutic results on the simple basis of "post hoc propter hoc" shows that enthusiasm is apt to weaken critical abilities. Lourdes has done better than all the authorities Aschner quotes, and yet I would still regard this as an insufficient reason to believe in miracles. Aschner conveniently forgets that in throwing out entirely bloodletting, purging, calomel, emetics, etc., a great number of licensed murders have been avoided, and that scientific medicine as a whole, which seems to Aschner nothing but error and suppression of healing abilities, has done not so badly, precisely when we evaluate it on an "empirical" basis. Things are really a little more complex than they appear to our author. Needless to say, Aschner, who goes back to the ancients in every respect, rarely supports his some-

times fantastic assertions with adequate data. So much on the medico-historical and theoretical parts of his book, which take up about one-third of his space.

There remain a good bibliography and a description of the different forms of arthritis, of the present-day orthodox methods of treatment and of the author's own methods and successes, based on more than twenty-five years of experience and illustrated with numerous case histories. This part is worth studying by all those engaged in the treatment of arthritis and rheumatism, in spite of the queer terminology, repetitiousness, and exaggerations of the author. He deserves our respect, because at least he has not forgotten that the essential task of medicine is healing.

ERWIN H. ACKERKNECHT

THE MODERN ATTACK ON TUBERCULOSIS. *Revised Edition.*

By Henry D. Chadwick and Alton S. Pope. The Commonwealth Fund, New York. $1.00. viii + 134 pp. 1946.

The epidemiology of tuberculosis and the problems it presents today in the United States are clearly set forth in this brief volume. The influence of such factors as age, sex, environment and heredity, occupation, and the relation of morbidity and mortality to infection are surveyed. Modern procedures of diagnosis and case-finding and the functions of the sanatorium are also discussed, particularly in respect to their roles in control of the disease, and emphasis is placed on the effective application of present-day knowledge and techniques and on the responsibility of the community in working toward eventual eradication of tuberculosis.

The present revision of the first edition, which was published in 1924, incorporates additional information on such subjects as rehabilitation, the financial aspects of diagnosis and care, the use of vaccines, and recent experiences with mass examinations of inductees and industrial workers. Although a little longer than before, the text is still brief and non-technical. It is distinguished by clarity, readability, and excellence in dealing with a subject on which a prodigious literature is available.

HARRIETTE VERA

LE CANCER: *Études biologiques, médico-chirurgicales et sociales, 1918–1943. Livre Jubilaire.*

Ligue Française contre le Cancer. Masson & Cie., Paris. 120 fr. (paper). 165 pp. 1944.

This volume was published in 1944 to commemorate the 25th anniversary of the Ligue Français contre le Cancer, and as the title implies, the problem of cancer is treated from many different points of view. The work consists of 24 brief articles by French specialists: two on the history of the society and the organization of anti-cancer centers throughout France; several on experimental cancer, including one on biochemistry and another on experimental mammary cancer; and numerous articles on diagnosis, surgery, and special techniques applicable to the treatment of neoplasms in the various parts of the body. As might be expected, considerable attention is given to radiotherapy.

In general the articles are brief, well-written, and to the point. When one considers the circumstances under which they were written (after years of enemy occupation), they appear very good indeed, and the authors deserve every commendation for their efforts. But the reader who seeks the last word on the problem is liable to be disappointed. Too much of the emphasis is on procedures and ideas as they exist in France; data from non-French sources, when mentioned at all, are likely to be out-of date. The chief value of the volume is probably historical, a summary of progress against cancer during the first twenty years of the past quarter century.

C. A. BAUMANN

FAMILIAL NONREAGINIC FOOD-ALLERGY. *Second Edition.*

By Arthur F. Coca. Charles C. Thomas, Springfield, Illinois. $3.75. xii + 191 pp. 1945.

The second edition of *Familial Nonreaginic Food-Allergy* adds little to the subject-matter contained in the first edition. Physicians with a knowledge of allergic diseases recognize hypersensitiveness to many foods and drugs as scientific fact. The symptomatology of such a condition is so well known that further comment is needless.

The author of this short treatise confuses allergic disease by his discussion of "idioblaptic allergic symptoms," which might be related to any circulatory, any cardiorenal, or any digestive disease. Psychiatric disturbance can also be included. The reviewer cannot accept the author's supposition that "idioblaptic allergy" is a distinct entity related to the ingestion of foods or drugs, nor can the reviewer accept the diagnostic method described in this treatise as sufficiently accurate to determine sensitivity.

The case reports are open to criticism. Especially unfortunate is the frequency wth which case A.F.C. is used to substantiate the theory that the author is attempting to prove. The subject matter of the report is interesting, but the author carries theoretical assumption too far for general acceptance.

LESLIE N. GAY

NARCOTICS AND DRUG ADDICTION.

By Erich Hesse; translated by Frank Gaynor. Philosophical Library, New York. $3.75. 219 pp. 1946.

The purpose of forwarding education about narcotics and drug addiction is an admirable one. That drug addictions admittedly constitute an important problem and that there is a place for a book written "in simple, non-technical and scientific language" are certainly true. However, the presentation for popular consumption of scientific material in a manner sound, and at the same time informative and interesting, is very difficult to achieve. This particular attempt has not been altogether successful. In the first place, many inaccuracies of construction and usage are present in the final form, either because of the preparation of the manuscript in another language or through translation. Generic names are generally not capitalized and the terms used are not always those customary. Repeated references to German laws, without a comparison with those of the United States, are not too likely to interest most readers. The inclusion of chemical formulae and descriptions of reactions, desirable in technical literature, are of dubious value here. In addition to these discrepancies, although the format is good, there are typographical errors and the printing is uneven.

The first half of the book deals with the characteristics of narcotics and the general extent of addiction to opium and its derivatives, coca and cocaine, hashish, mescaline, and other substances with more or less similar properties. The latter part of the book discusses alcohol, tobacco, coffee, tea, cola, cocoa, betel chewing, and other stimulants. The closing chapter is devoted to rare addictions and to over-indulgence in soporifics.

HARRIETTE VERA

PERSONAL HYGIENE APPLIED. *Eighth Edition. By Jesse Feiring Williams. W. B. Saunders Company, Philadelphia and London.* $2.50. xx + 564 pp. 1946.

This well-known text has been revised in accordance with recent events and scientific developments. The concept of personal hygiene is a broad one and is developed around the theme: "to live most and to serve best." Discussion has been kept simple, is rather philosophical and is not highly technical. Material has been rewritten or added to such subjects as fitness, exercise and rest, nutrition, caries, and blood banks. The book is arranged as in prior editions, with a list of questions and exercises at the end of each chapter, and with suggested topics for term reports and a true-false test appended.

HEALTH GUIDES AND GUARDS. *Third Edition*

By Francis P. Wall and Louis D. Zeidberg. Prentice-Hall, New York. $2.75. ix + 392 pp. 1946.

About two-thirds of this textbook are devoted to personal hygiene and the remainder to public health. In the first part the systems of the body are discussed under the subheadings of structure, functions, diseases, and hygiene. The importance of the reproductive system is emphasized, and there are separate chapters on gonorrhea, syphilis, and chancroid. The section on community hygiene briefly considers principles of immunity, specific diseases transmitted in various ways, control of water and milk, sewage disposal, and the like. The closing chapter is on public health administration. This is followed by a series of questions on detachable pages, one page for each chapter.

The presentation of subject matter is straightforward, practical, and comparatively simple. Occasionally the reader might prefer less simplification and the use of more definitive terms. For instance, the word "carbohydrates" appears to be sufficiently understandable to be used instead of "starches" in referring to energy foods.

HARRIETTE VERA

CLEANLINESS AND GODLINESS *Or The Further Metamorphosis: A Discussion of the Problems of Sanitation raised by Sir John Harington, together with Reflections upon Further Progress recorded since that Excellent Knight, by his Invention of the Metamorphosed Ajax, Father of Conveniences, revolutionised the System of Sanitation in this country but raised at the same time fresh Problems for Posterity which are discussed in all their implications, with numerous digressions upon all aspects of Cleanliness by the author.*

By Reginald Reynolds. Doubleday and Company, Garden City, New York. $2.75. x + 326 pp. 1946.

According to the title page, the author would have this "A discussion of the problems of sanitation, etc. . . ." (see above). He commences by describing the advent of plumbing against a background of sanitary provisions in prehistoric cities, in Egypt, Greece, and the Roman Empire. The influence of religious regulations upon personal hygiene among the Hindus and Moslems is contrasted with the conditions and practices prevailing in Victorian England.

As population increased, and with it the pollution of waterways and the development of household conveniences, the outstanding problem which arose was that of sewage disposal. Due homage is paid to Sir Edwin Chadwick in his struggle for the awakening of the public consciousness of responsibility for disease prevention. "You owe your water-closet to Edwin

Chadwick and Dr. Cholera, one persuading and reasoning, the other punishing and threatening."

The fresher problem with which this generation must deal is the conversion of sewage disposal into sewage utilization. The author is impressed by the economic soundness of the utilization of wastes, but is mainly concerned with soil impoverishment due to the use of chemical fertilizers and to failure to replace biologically necessary soil components.

The digressions are numerous and interesting—for example, those on inertia, taboos, and bathroom libraries. The profligacy of modern times is condemned, but the author practises no frugality of words. The intestinal approach to life is well and amusingly made, though perhaps with overmuch protestation.

HARRIETTE VERA

PREVENTIVE MEDICINE AND PUBLIC HEALTH.
By Wilson G. Smillie. The Macmillan Company, New York. $6.00. xvi + 607 pp. 1946.

Planned as a text for medical students, the point of view is here maintained that the practising physician "has the obligation . . . to prevent illness and to promote family and community health." The distinction between preventive medicine as an individual responsibility and public health as a community function is emphasized.

Of the six sections in the book, the introductory one contains a remarkably detailed discussion of vital statistics. The following section deals with environmental sanitation—the subject being treated much more briefly than has often been customary and probably rightly so, since the book was not written for public health workers. The last four parts consider the problems of communicable disease control, child hygiene, adult health protection and promotion, and public health administration.

In an otherwise outstanding contribution, there are some few defects. Most important of these is occasional inaccuracy or poor choice of terms, a fault which might easily have been eliminated by more careful editing. The references are sometimes placed at the end of the section and sometimes after each chapter.

Excellent in conception, the book is, on the whole, forcefully and interestingly written. The illustrative use of the case history is notable, and the presentation of controversial subjects is competently handled.

HARRIETTE VERA

MEDICAL SERVICES BY GOVERNMENT: *Local, State, and Federal. Studies of the New York Academy of Medicine Committee on Medicine and the Changing Order.*
By Bernhard J. Stern. The Commonwealth Fund, New York. $1.50. xviii + 208 pp. 1946.

Medical services provided by government in this country at first and still very largely comprise those services financed by local units (city, township, and county), which according to the Anglo-Saxon Poor Laws are responsible for the indigent sick. These services have often continued to retain the flavor of their origin, though the basic moral attitude of the poor laws can no longer be maintained. To local home and hospital care, school services have been added. New plans center either around local health departments or hospital–health centers. State governments act by supervision and by making grants in aid to local jurisdictions, and have developed greatest activity in the field of mental hospitals and tuberculosis sanatoria. The shift in hospital investment from private to public sources has been dramatic between 1927 and 1937, the proportion (71.5% to 28.5% respectively) having been quite reversed. The Federal Government is more and more becoming, through the US Public Health Service, the center of government health services. The US Public Health Service controls the Marine Hospitals, the services for migratory workers, the venereal disease and tuberculosis control programs, the Office of Vocational Rehabilitation, the FECC, and many other agencies. The Childrens Bureau supervises maternal and child health programs, and the EMIC. At present the most extensive medical enterprise of the Federal government is, of course, the Veterans Administration.

This survey, clear, substantial, and up to date, will be most welcome to all those who seek information on a rather intricate matter.

ERWIN H. ACKERKNECHT

PSYCHOLOGY AND ANIMAL BEHAVIOR

CATS IN A PUZZLE BOX.
By Edwin R. Guthrie and George P. Horton. Rinehart & Company, New York. $1.50 (paper). x + 67 pp. 1946.

This monograph describes more than 800 observations made over a period of three years, of the behavior of cats in learning the solution to a puzzle box. Cats were permitted to enter the puzzle box after being restrained briefly in a starting box. They could escape through a door in the front of the box and obtain food, only when they had moved a post standing upright in the box. The movement of the post, which released the catch holding the escape-door, could be accomplished in a variety of ways: by biting, clawing, rubbing, rolling, falling, or backing into the post.

The objective was to study the sequence of movements leading up to the solution of the problem and

to determine the importance of the laws of reward and association in learning the sequence. Three important features of the learning behavior were noted: (1) a tendency to repeat movement-series in remarkable detail; (2) the appearance of new movement-series; and (3) a tendency for the final series of movements leading up to the solution to be more stable and repetitive than the preliminary behavior.

The authors believe that new behavior series, when they occur, are caused by distracting stimuli in the environment or within the animal, and by the fact that many kinds of behavior are self-terminating and must be followed by new behavior. The remarkable repetition and stereotyping of behavior series, however, lead them to conclude that a principle of association is sufficient to account entirely for the learning in the box. They conclude, further, that reward, i.e., escape from the box and obtaining food, has no importance *per se* in the learning but serves only as the factor that terminates the movement-series. Reward, consequently, determines that the movements leading up to escape will occur more often than other movements and thus will become more strongly associated with the stimuli of the situation. The authors believe that a similar analysis applies equally well to more complex learning by higher animals and human beings.

The associative theory of learning which has been put forward in this monograph has previously been advanced by the authors and other psychologists, but the monograph is a major contribution to the field of learning because the experiments which it describes constitute the most painstaking and crucial evidence offered thus far for the associative theory.

CLIFFORD T. MORGAN

PRACTICAL PSYCHOLOGY.

By Karl S. Bernhardt. McGraw-Hill Book Company, New York and London. $2.50. x + 319 pp. 1945.

Anyone who makes a practice of reading new books in the field of psychology with any regularity will have been impressed, and probably depressed, by the astonishing consistency with which authors and publishers have taken to misnaming their books.

Practical Psychology might have been called 'A Psychological Primer.' In its first (Canadian) printing, it was actually called *Elementary Psychology*, which is a more appropriate but still over-ambitious title. The book is a congeries of historical, theoretical, and (occasionally) practical information. It has been written for readers who have had no training in the sciences and little or no genuine motivation to understand psychology. It is hard to conceive of an audience to whom this book could be honestly recommended. Perhaps high-school students who wish to get a brief survey of the content of psychological courses in college might get it from Bernhardt's book, but even they could get the same information with equal ease and more profit elsewhere.

W. C. H. PRENTICE

PSYCHOLOGY FOR NURSES: *Designed and Written for Student Nurses.*

By Bess V. Cunningham. D. Appleton-Century Company, New York and London. $3.00. xx + 336 pp. 1946.

It is difficult for psychologists who are not experienced in nursing-education to make any final assessments of textbooks which are designed primarily for this special kind of application. The book which Cunningham has produced, however, is clearly a credit to psychology even if judged as a basic college text. The book is well organized, up to date, and readable; it presents the student with very useful annotated bibliographies for each chapter as well as with complete reference material for all facts and experiments cited in the text. In a few places, notably in Chapters 1, 2, and 3, the special emphasis on psychology as it is related to nursing dominates the writer's point of view. In these places, and in the occasional special references throughout the book, there is every appearance of a well integrated and balanced presentation of the psychological aspects of the nurse's job.

It must be pointed out, however, that a fairly considerable portion of the information included in this book is of a kind which will probably never have any direct practical application to the nursing profession. Only those who are actively engaged in the education of nurses can judge whether or not that is desirable. The reviewer feels strongly that not even a nurse can learn too much, and that the better the student has been able to see psychology as a whole, the more complete will be her grasp of practical application.

In short, this textbook can be strongly recommended to any school of nursing that can afford to give its students a really thorough course in general psychology.

W. C. H. PRENTICE

PRINCIPLES OF PSYCHOLOGY *for the Basic Course in Nursing.*

By Rev. J. Edward Rauth and Sister M. Maurice Sheehy. The Bruce Publishing Company, Milwaukee, Wisconsin. $2.00. xvi + 200 pp. 1945.

Although this text is a product of two members of the staff of Catholic University, it reveals a refreshing freedom from bias and a remarkably adequate treatment of the data of psychology. The authors have skillfully documented the various chapters with ap-

plications of psychology to the field of nursing and although general psychology is adequately treated, the authors' presentation of the data of abnormal psychology completes the picture for the student nurse.

The chapters on feelings, emotions, and personality, so often poorly treated in elementary texts, are satisfactorily outlined, yet allow ample opportunity for the teacher to expand the framework and further document the topics. While the authors have a marked practical approach in selecting material, this in no way detracts from the presentation of scientific data. It is pointed out in the foreword that professedly mechanist psychology is unsuitable for Catholic nurses; yet in putting a soul into psychology, the authors have been most conservative.

The chapter on learning and the section on study habits and techniques of learning are presented in a manner which should assist the student not only in her individual training problem but also in her approach to other courses of instructions. The succinctness of the text together with the ample glossary should provide a useful teaching tool in any school of nursing.

VERNON P. SCHEIDT

PSYCHOLOGY FOR THE ARMED FORCES. *Prepared by a Committee of The National Research Council. Edited by Edwin G. Boring. The Infantry Journal, Washington, D. C.* $3.00. xviii + 533 pp. 1945.

The success of a pocket book on psychology, published during the war by the Infantry Journal and the N. R. C., has inspired its authors now to produce an enlarged edition under a new title. In point of fact, this is much more than a re-issue or re-editing. *Psychology for the Fighting Man* was a practical handbook for soldiers and sailors, written so that individual men in the service could read it without supervision or instruction and find the answers to some of their immediate problems; *Psychology for the Armed Services* provides for the first time a college-level textbook suitable to the special needs of the military academies.

We become so used to uninspired writing and to academic values in textbook design, that many readers will be tempted to challenge the assertion that this book is really pitched at the college level. In the first place, it is an example of applied psychology and leaves out many of the more theoretical issues to which we usually expose students in liberal colleges. In the second place, it is interesting, even arresting, on almost every page. 'Popular' and non-academic books do not seem like college books at first. What this text has in fact accomplished, however, is the organization of a very great amount and diversity of sound scientific information into a volume which is built around military problems. The 'applied' psychology is consistently supported by fundamental information and even with a surprising amount of basic theoretical discussion, much of which is well camouflaged because it is written as interestingly as the more practical sections.

The three major problems which the editor faced have all been solved. First, the problem of making elementary psychology readable; second, the problem of limiting discussion to those problems which concern military readers without descending to superficiality; third, the problem of surmounting the numerous difficulties attendant upon collaborative writing and of achieving in spite of them a coherent and purposeful text.

For the first time, we now have a real textbook on military psychology as such. There should no longer be any excuse for officers to be graduated from West Point or Annapolis without at least the groundwork of modern psychology as part of their technical equipment.

W. C. H. PRENTICE

MANUAL OF CHILD PSYCHOLOGY. *Edited by Leonard Carmichael. John Wiley & Sons, New York; Chapman & Hall, London.* $6.00. viii + 1068 pp. 1946.

This is a massive reference book on child psychology compiled by Leonard Carmichael, president of Tufts College and also director of the Tufts' Laboratory of Sensory Psychology and Physiology. He himself wrote Chapter II, a scholarly paper reviewing in detail work done on "The Onset and Early Development of Behavior." The other eighteen chapters, covering different phases of child development as observed and recorded by research psychologists, are contributed by other outstanding people in the field. For example: John E. Anderson, Professor of Psychology and director of the Institute of Child Welfare at the University of Minnesota, begins the volume with a treatise on "Methods of Child Psychology"; Arnold Gesell, well-known research worker in child psychology, reviews the work done on "The Ontogenesis of Infant Behavior"; Florence L. Goodenough, professor at the University of Minnesota, has contributed a paper on "The Measurement of Mental Growth in Chidhood"; Margaret Mead, associate curator of Ethnology at the American Museum of Natural History, presents an article covering "Research on Primitive Children"; and Lewis M. Terman, Emeritus Professor of Psychology at Stanford University, has a paper reviewing work done on "Psychological Sex Differences." This is only a partial listing of the contributing authors, each of whom is equally well prepared to write a definitive article on the subject which he was assigned.

Each of the chapters is oriented so as to give as thorough a survey of the pertinent research work as pos-

sible. Comparisons of various views are made, and often the author points up phases of the work which await further scientific attention. Dorothea McCarthy, for instance, in her paper on "Language Development in Children," makes several suggestions for future studies, among them being the idea that "further investigation of the pre-linguistic utterances of infancy" would be very helpful. In addition, following each chapter there is an impressively complete bibliography of the literature on the subject under consideration.

It is almost impossible for anyone less than a national authority on psychology to attempt a criticism of such an apparently complete compendium. It is to be assumed that this volume will be an essential reference text for postgraduate psychology students and all others interested in learning or evaluating what research psychology has contributed to our basic understanding of the complex phenomenon of an individual's development from fetal life to maturity.

HELEN HEWITT ARTHUR

CHILD PSYCHOLOGY FOR PROFESSIONAL WORKERS. *Revised Edition.*

By Florence M. Teagarden. Prentice-Hall, New York. $3.75. xxii + 613 pp. 1946.

Florence Teagarden presents her book, now in its second edition, as a complete text on child psychology for the use of nurses, social workers, and teachers. She has succeeded admirably in covering the tremendous field thoroughly and in making her points intelligible to the most naive student without being boring.

The author begins, appropriately for her reading public, with the simple facts of heredity—the sex cells, how they develop, mature, and become fertilized, the Mendelian Laws of heredity, human genetics, and so on. Each topic is taken up straightforwardly, on the assumption that the intended reader is having it discussed for the first time but is ready for the real facts at this point. The book continues, logically and in amazing detail taking up next the facts of birth. Here Florence Teagarden, among other things, debunks various popular superstitions, gives data on estimating the E.D.C., explains blood grouping, takes up the registration of births, comments on unmarried mothers, and generally gives a sort of over-all view of obstetrics and associated topics.

In the same direct and thorough manner the author takes the reader through the several phases of a youngster's normal development, examines the problems he meets in his different contacts both within and outside the home, discusses most objectively the child's sex life, takes up behavior problems as such, and spends several chapters in considering how children are affected by organic disease or physical handicaps of various sorts.

The book is written in a very readable, matter-of-fact style, comfortably interlarded with homey little personal phrases which somehow never annoy but serve instead to break up the pedantic approach. The book is a masterpiece of organization without the usual irritating feature of paragraph headings. The outlining is all done in the Table of Contents, leaving the reader free to absorb ideas unencumbered by a protruding structural skeleton. Following each chapter there is a useful list of appropriate references.

Florence Teagarden, through her book, gives the impression of being a soundly educated person who believes in Common Sense and the principle of being very Kind but Firm. While she is apparently aware of modern developments in psychodynamics and different theories regarding child development, her weight definitely rests in the conservative balance. She is not reactionary but rather pleasantly objective—no fiddling with abstractions for her. In the first place, she has no time for them; and in the second place, the group for whom she is writing is not ready to deal with much theory.

This is a book which should be included on reading lists for non-psychiatrically oriented social work students and for nurses, particularly those interested in Public Health work. It is admittedly a primary text but it is fine enough to stimulate a bright reader to go deeper into the subject.

HELEN HEWITT ARTHUR

THE ADOLESCENT IN SOCIAL GROUPS: *Studies in the Observation of Personality. Applied Psychology Monographs, Number 9, of the American Psychological Association.*

By Frances Burks Newman, with an introduction by Harold E. Jones. Stanford University Press, Stanford University, California; Geoffrey Cumberlege, Oxford University Press, London. $1.50 (paper); $2.00 (cloth). 94 pp. 1946.

This monograph is a study of observation techniques and rating scales developed for and applied to a group of adolescent boys and girls. A number of psychologists participated in this Adolescent Growth Study over a period of years as the youngsters progressed from the fifth to the twelfth grade. Every effort, apparently, was made to get a complete sampling of each child's behavior at different age levels and in a variety of situations. For this purpose elaborate charts were worked out to cover all sorts of reactions and copious verbatim accounts of activities were recorded. The aim of this monograph, however, is not to comment on the results of this mass of accumulated data but rather to draw

conclusions as to the efficiency and accuracy of the rating methods employed.

The author feels that this project has pointed up "the value of 1) varied and 2) extensive observational records" in attempting a study of the difficult adolescent period. Certainly, in terms of painstaking examination of the records for internal and inter-correlations, in terms of a detailed analysis of possible sources of human error or bias with compensatory checks for just such factors, and simply in terms of over-all thoroughness, Miss Newman's research is impressive and corroborates her conclusion. Undoubtedly, this paper has much to contribute to the field of psychology, where one of the chief needs is the further development of honest, accurate, and comprehensive measuring apparatus for human behavior, particularly in such a labile area as adolescence. However, from the point of view of the clinical psychiatrist, it is to be hoped that soon the data garnered under this presumably successful (if complicated) system will itself be analyzed and a statement made as to what it can contribute to our understanding of the adolescent.

HELEN HEWITT ARTHUR

PREDICTION OF THE ADJUSTMENT AND ACADEMIC PERFORMANCE OF COLLEGE STUDENTS. *By a Modification of the Rorschach Method. Applied Psychology Monograph Number 7 of the American Association for Applied Psychology.*

By Ruth Learned Munroe. Published for American Association for Applied Psychology by Stanford University Press, California. $2.00 (cloth); $1.25 (paper). 104 pp. 1945.

Not only psychologists and psychiatrists, but all who are concerned as teachers or educators with prediction of the success of students in college will find this monograph of considerable interest. It reports the results of a Rorschach study of all entering students at Sarah Lawrence College (women) in 1940, 1941, and 1942, and the comparison of the 348 individual predictions made on the basis of the Rorschach test with (a) the student's record on the American Council on Education Psychological Examination (ACE), (b) the student's adjustment during her whole college career as "measured by the amount of concern about her problems expressed by teachers through the faculty committee. . .and through referral to the college psychiatrist," and (c) the student's scholastic average after one year. Evaluation of the Rorschach protocols was triple: a descriptive sketch of the personality; a rating predicting academic standing; a rating on adjustment. The descriptive sketch was found to have a high correlation with teacher opinion, and predictions of academic success also manifested high validity. It was with the rating on adjustment, however, that most significant results were obtained in regard to academic success as well as general adjustment. ACE scores were more successful in predicting academic success, but Rorschach adjustment ratings were more successful in predicting academic failures. A combination of the two measures yielded very good practical prediction for three-fourths of the group, and ought to serve as an excellent guide to admission to college.

EMOTIONS AND BODILY CHANGES: *A Survey of Literature on Psychosomatic Interrelationships 1910–1945. Third Edition.*

By Flanders Dunbar. Columbia University Press, New York. $7.50. lix + 604 pp. 1946.

This large volume is an essay in bibliography with the objects of stimulating and facilitating investigation, and of improving therapy in the field of psychosomatic interrelationships. The author states: "There has been no attempt to cover the literature thoroughly or even to select the most significant contributions made by the authors cited. . . .Frequently where representative articles have been chosen from among several, preference has been given to those with the most adequate bibliography." The bibliography of the first edition, around which the volume is largeyl organized, comprises 2,251 titles. Supplemental bibliographies for each of the subsequent editions bring the total to 2,400 titles.

The text of the book is organized in three divisions. The first comprises three introductions to the several editions. The first of these states simply the reasons for the undertaking and some of the difficulties encountered. The second and third supplement the unrevised text of the first edition.

The main part of the text is again divided into three sections. In part one, which is headed Orientation and Methodology, the author exhibits her point of view explicitly, and implicitly also her limitations. The author's point of view, that psyche and soma are a unity (organismal point of view) is well presented, and is supported by quotations that range from Socrates and Hippocrates to current thinkers; yet contrary philosophies also receive recognition. The sweep of thought brought together in this section is extremely stimulating. Examined more minutely, the limitations of selection are, however, noticeable. For example, this section contains a brilliant recapitulation of Coghill's results and conclusions derived from his many years' study of the development of somatic motor function in *Amblystoma*, elegantly coordinated with other observations in support of the unitary, or organismal, point of view. That there are discordant observations and opinions in this special field of study is not even indicated. The book is deceptive, there-

fore, in seeming to entertain all points of view while actually it develops a particular thesis.

Part two, dealing with Organs or Organ-systems, presents the studies available, or selections from among them, on the psychosomatic interrelationships as they operate in the several functional systems. This is done with little comment and no attempt to summarize or interpret.

The third part, headed Therapeutic Consideration and Concluding Remarks, is forthright, practical, and brief. The preponderance of psychoanalytic observation and theory in the volume is here explicitly recognized, and the reasons for it are made clear.

Considered as a whole, this volume endures as an important and useful work of bibliography serving the thesis that psyche and soma are interrelated. More than this, the less strictly bibliographical parts of the text are exciting in the sweep of their correlation, although it should be borne in mind that these date largely from 1935, and that much has been contributed since then. Altogether, the volume is a marker at a turning in the course of medical development. Not itself responsible for the turning, it points and eases the way for those who would take the new course.

SARAH S. TOWER

THE BIOLOGY OF SCHIZOPHRENIA.

By R. G. Hoskins. W. W. Norton & Company, New York. $2.75. 192 pp. 1946.

This book is a "slightly amplified version" of the authors' Salmon Memorial lectures given in November, 1945. The material presented is predominantly that which was gained during eighteen years of labor by a group of co-workers at the Research Department of the Worcester State Hospital under Hoskins' directorship. Since Hoskins is a physiologist, it is to be expected that his approach to a major psychiatric problem and his conclusions will reflect a physiologist's point of view. The author is well aware that many a psychiatrist may think it a biased approach.

Throughout the discourse the term schizophrenia is used in the sense of "process schizophrenia" or "constitutional" schizophrenia, which "should be set aside from the various schizophreniform reactions that are frequently grouped with the true psychosis." "From the general biological point, however, . . .the possibility must still be faced that 'schizophrenia' may be an entity by fiat only, as are disorders in general that are delimited merely on a basis of symptoms."

The schizophrenia represents a failure or distortion somewhere in the course of the integrative series as we know them from the biology of man; and it could exist at any level of integration from the atomic to the social.

Schizophrenic patterns are not observed in "lower orders of creation"; it is a strictly human disorder. Responsible for this fact might be the greater vulnerability of human beings, due to prolonged childhood and habituation to symbolism, which adds to the difficulty of reality-testing.

Among human patterns which can be compared to schizophrenia, the following are discussed: normal childhood, dreams, cerebral injury, and feral human beings—the so-called "wolf children." However, no satisfying answer can be given to all these suggestions, or to others concerning the fundamental nature of schizophrenia—whether it is an adaptation or a disease; whether it has any survival value for the individual or for the species; or whether it represents a mutation, arising on a particular genetic basis.

In a third section the author discusses in some detail the psychosomatic aspects of schizophrenia, using mainly the results of his own and his co-workers' extensive, painstaking, and brilliant experiments, especially those at the physiologic-metabolic level. There are chapters on *hormone disabilities;* on the *oxygen-metabolism,* with the suggestion that the defective oxygen assimilation found in schizophrenia may have its causes in the tissues—and that means in their enzyme-systems—rather than in defects of oxygen supply; on *circulatory conditions,* stressing the significant fact that the schizophrenic is less efficient than normal in making adaptive adjustments to local and passing demands upon the circulatory mechanisms; on *temperature regulation;* on *equilibrium reactions,* pointing out that the schizophrenic is substantially less than normally reactive in regard to his equilibrium functions; and finally on *homeostasis,* emphasizing again the reduced ability of the patients to maintain metabolic steadiness under conditions in which such steadiness would be regarded as a mark of psychosomatic stability. A "physiological clumsiness," rendering the subject less tolerant to stress, may serve as a "decompensation factor." "It would seem that the prodigality of effort required for organic adaptation leaves the patient with but inadequate energy for successful adaptation in the social field."

Summarizing his findings and conclusions, viewed in this biological frame of reference, Hoskins proposes the following concept: "The schizophrenic psychosis represents an end result of a generalized failure of adaptation that arises from defective evolution of the maturing processes. The failure is manifested in an intricate variety of ways, but especially in defective homeostasis—somatic and psychic—defective empathy, and final overall disintegration of the personality. The accessory symptomatology of the psychosis can be regarded as constituting secondary adaptations to the difficulties arising out of the primary defect."

An alternative to this "immaturity" concept of schizophrenia is that the psychosis may be due to a specific pathology, which leads to "decompensation."

However, such specific pathology might exist in abnormalities of enzyme systems in the brain, and the postulated immaturity might have quite possibly its origin in just such a specific pathology. Yet the following deduction will reveal how baffling the entire problem still is; how little we actually know; how much is mere conjecture; and how small a difference actually exists between concepts which seem to exclude each other. Hoskins mentions that many of the disturbbances of homeostasis might be results merely of defects in the hypothalamic region; and says that, if one chooses to regard the schizophrenia as "merely a functional disorder due to malconditioning in the broad sense, it is quite possible that it is via the hypothalamus that the disorder is chiefly mediated."

The psychiatrist with no "organic" inclinations or bias might well be satisfied to see how a very intensive and extensive physiological research program, conducted under a broad biological point of view and carried out by admirable teamwork has nevertheless failed to show any conclusive evidence of the assumption that the schizophrenic psychosis has an "organic" basis; that it is fundamentally due to some disturbance at a low level of integration. To the reviewer, however, it is quite conceivable that such low-level deviation may be detected; that it may be found by a physiologist rather than a psychiatrist, and that it may open a new era of treatment and prophylaxis.

At any rate, the book provides stimulating reading. It may help younger and inquiring psychiatrists to clarify their own concepts, and perhaps even induce one or another to pursue further the "biological" road toward what might prove to be the mainspring of the psychosis. In doing this, it may not even be necessary to disregard—as Hoskins advises—"the further pursuit of that will-o'-the-wisp, that semiprojective synthetic artefact, 'the patient as a whole'."

W. O. JAHRREISS

SCIENCE AND SEIZURES: *New Light on Epilepsy and Migraine. Second Edition.*

By William Gordon Lennox. Harper & Brothers, New York and London. $2.00. xiii + 258 pp. + 1 plate. 1946.

This book, by the president of the American Epilepsy League, Inc., tells about all there is to know about epilepsy and migraine from every aspect, from the historical, the diagnostic, the neurophysiological, the psychological, the etiological, and from that of treatment and prevention. It is full of odd facts of an historical nature and is packed full of useful information for the practitioner and research worker. It is just about the last word on the subject.

WENDELL MUNCIE

THE MENTALLY ILL IN AMERICA. *A History of Their Care and Treatment from Colonial Times.*

By Albert Deutsch, with an introduction by William A. White. Columbia University Press, New York. $4.00. xvii + 530 pp.; 8 plates. 1946.

This is a reprint of Deutsch's book, which has not been available for some time. It is an authoritative account of the history of psychiatry in America as exemplified in the care offered to patients, and as such it manages to avoid the pitfalls of the history of psychiatry which deals with the various philosophies. The author skillfully covers the whole course from Colonial times down to the present by forcefully portraying the principal figures in American psychiatry, including Dorothea Lynde Dix and Clifford Beers.

There are chapters concerning the medieval criminal laws, commitment laws, and worth-while details of modern trends in institutional care. This is an excellent book, stressing the social aspects of psychiatry. A great deal of research work went into its preparation, and this reprinting will be most welcome.

WENDELL MUNCIE

CURRENT THERAPIES OF PERSONALITY DISORDERS. *The Proceedings of the Thirty-fourth Annual Meeting of the American Psychopathological Association, held in New York City, April, 1945.*

Edited by Bernard Glueck. Grune & Stratton, New York. $3.50. viii + 296 pp. 1946.

This volume contains the papers presented at the 1945 meeting of the American Psychopathological Association and deals in general with the four following topics: the modern psychiatric hospital; the psychotherapeutic techniques in psychiatry; psychiatric guidance and rehabilitation techniques; and the physiochemical techniques in psychiatry.

This collection of papers presents nothing outstanding and nothing particularly new, but various aspects of these four problems are handled by experienced workers. There are three articles dealing with group psychotherapy, a problem very much in the forefront of our thinking today. Robert P. Knight's contribution on "The Place of Psychoanalytic Therapy in the Mental Hospital" is especially commendable.

WENDELL MUNCIE

PSYCHIATRY TODAY AND TOMORROW.

By Samuel Zachary Orgel. International Universities Press, New York. $6.00. 514 pp. 1946.

The publishers comment upon this book in the following terms: "True to his conviction that the mental patient is no longer the province of the psychiatrist alone, but

the responsibility of the entire community, Dr. Orgel has succeeded in combining material of equal importance for the general public and for doctors, nurses, social and welfare workers, teachers, lawyers, and clergymen." A successful combination of this kind within the covers of one book is not practicable except within a very limited sphere. It is possible, for example, to make certain observations about mental illness from one particular standpoint that would contain matters of interest for all the groups enumerated above. The author has, however, attempted much more than this. He has attempted to write a quite comprehensive manual of psychiatry, following approximately in outline the nosological and Kraepelinian classification approved by the American Psychiatric Association, at the same time emphasizing throughout the Freudian dynamic concepts of the etiology of the various disorders. He has added to this an account of the history of psychiatry from ancient times to the present; and he has also given a brief account of medical and nursing treatment, occupational therapy, social work, war psychiatry, etc.

Each of these aspects of his subject has been the subject of detailed textbooks, and each would demand somewhat different treatment for each of his several groups of prospective readers. The first reaction of the reviewer is that Orgel has attempted a hopeless task, but the second is that he has made a very gallant attempt indeed. It is difficult to judge the reaction of a lay reader to the book, but it does contain much that is of interest to a psychiatrist. At many points the reader finds himself following the line of reasoning or the fruits of his reading with sustained and lively interest, only to be disappointed that the author has not space enough at his disposal to pursue his technical observations further. The abbreviated accounts of Freudian dynamic ideas frequently do justice neither to Freud nor to the author of the book. His account of the Oedipus situation, for example, is expressed in so condensed a fashion as to be actually or potentially misleading, and his account of the etiology of neurosis suffers from the same weakness. Indeed, the whole section concerned with neurosis is one of the weakest in the book, a pity when one considers the great importance of that subject to lay and medical readers alike.

In dealing with the major psychoses the author is obviously on much surer ground, and he writes simply and clearly. Under the heading of manic depressive psychosis, he makes one statement which is quite at variance with common experience, namely, that recurrent depression is less frequent than recurrent mania. Fortunately the reverse is usually found; recurrent depression, masquerading under many disguises, is one of the great causes of human illness and unhappiness. It is also the condition above all others which can successfully be alleviated by electroshock therapy. This is true to a far less extent of recurrent mania, which, although it may bring less suffering to the individual himself, is more distressing to his family and friends and more difficult to control.

The book contains interesting chapters upon occupational therapy and social work. It is perhaps to these two groups of workers, already possessed of a background of psychiatric knowledge, that it will prove especially valuable as a work of reference. In the same manner it should serve the purpose of the graduate nurse who is studying the subject more fully. The author is to be congratulated upon the very considerable measure of success which he has achieved in his exceedingly difficult task.

C. H. ROGERSON

PSYCHOANALYTIC THERAPY: *Principles and Application.*

By Franz Alexander and Thomas Morton French with Catherine Lillie Bacon, Therese Benedek, Rudolf A. Fuerst, Margaret Wilson Gerard, Roy Richard Grinker, Martin Grotjahn, Adelaide McFadyen Johnson, Helen Vincent McLean, and Edoardo Weiss. The Ronald Press Company, New York. $5.00. xiii + 353 pp. 1946.

This volume represents the effort of the Chicago Psychoanalytic Institute, headed by Alexander and French, to formulate their current ideas regarding therapy. The book is divided into two sections: Part I, dealing with the theoretical aspects or principles which have been evolved; and Part II, presenting actual cases that show the application of these principles.

The first two chapters are devoted to a concise, judiciously pruned historical account of the evolution of psychoanalytic thinking to the point where it can be shown that Alexander's ideas are simply the "next step" proceeding from ideas of Ferenczi and Rank. This is an important bit of groundwork to lay, for certainly, as the material unfolds, it will occur to anyone versed in traditional lore that this is hardly the accepted version of Freudian psychoanalysis.

Alexander next develops the Principle of Flexibility, stressing the fact that length of treatment, frequency of interview, interruptions during treatment, and handling of transference relationships should be considered carefully in terms of the individual patient and used accordingly. Some patients react better to interviews scheduled once a week, for example, than to more frequent sessions. He points out problems which occur with a patient simply because he is treated not individually but in routine fashion, with the analyst adhering rigidly to the traditional approach. The real therapeutic goal should be, he says, to accord the patient a "corrective emotional experience," and

this can only be done by a careful assessment of what will comprise such an experience, wasting as little time as possible over extraneous analytic sessions.

French then takes over, with a discussion of the transference phenomenon, particularly as it is utilized in this "flexible" analytic approach. Here again the value of investigating just what will be most helpful to the patient is stressed. There is no need in many cases, according to French, for the inevitable development of an unwieldy, time-consuming transference neurosis. It is important to size up as soon as possible the treatability of an individual patient, and then to block out along psychodynamic principles an appropriate plan of therapy. The authors make the point emphatically that with this custom-built approach much in the way of a symptomatic cure can often be accomplished in a relatively brief time. In fact, 'brief psychotherapy' is regarded as one of the most significant contributions of this new psychoanalytic thought.

The selected case histories, twenty-one in all, are presented by different members of the Institute staff. The cases range from those seen efficaciously in a single interview up to those seen for a total of sixty-five therapeutic sessions apiece. Each case was chosen for a specific reason, to strengthen and illustrate parts of the text and so to add a great deal to the reader's understanding of the didactic material.

This is a thoroughly stimulating and provocative book for anyone who is interested in dynamic psychotherapy. Despite the fact that eleven people actually wrote the book, there is uniformity of style throughout and a minimum of professional jargon. The volume is extremely readable, with its ideas presented lucidly and logically.

There is one major criticism to be made, however. The authors somehow make the whole process of "brief psychotherapy" too easy. They are almost too glib in explaining and fortifying their claims. A casual reader may forget that all the members of the Institute who have contributed to this work are people with long years of arduous experience in the formal analytic frame. The ability to estimate the "ego strength" of a new patient, to plan an intelligent individualized course of treatment, or to juggle the transference situation dexterously is not developed through reading. It is a process that can only be recommended to mature psychiatrists, a point that is hardly mentioned in this book. There is a real danger that young, inexperienced psychiatrists may be deceived into thinking that "brief psychotherapy" is a tool for them, particularly since it protects them from encountering the deeper structural difficulties which they are unprepared to handle.

In addition, the question must arise as to how much of a "cure" can be effected in a "psychoanalysis" of five sessions. All the cases presented, of course, showed a remarkable and generally carefully explained improvement which was maintained to the time of publication. In some there was a relatively short interval of observation. It is to be hoped that Alexander and French will soon be able to add to this volume another one in which a follow-up study will be made in an attempt to evaluate more accurately just what this brief treatment does for patients and perhaps to elucidate further its pitfalls as well as its advantages.

HELEN HEWITT ARTHUR

PRINCIPLES OF DYNAMIC PSYCHIATRY *Including an Integrative Approach to Abnormal and Clinical Psychology. With a Glossary of Psychiatric Terms.*

By Jules H. Masserman. W. B. Saunders Company, Philadelphia and London. $4.00. xix + 322 pp. 1946.

In this volume the author has attempted to define a behavioristic psychiatry, essentially making an effort to fuse his interests in psychobiology, psychoanalysis, and animal experimentation of the conditioned reflex sort. This results in what he calls "biodynamic" formulations of behavior, thereby introducing the only new term in the text. He discusses, in Part One, the development of behavior theory from the historical standpoint, the psychologic concepts of behavior, psychoanalytic concepts, dynamics of adaptation, and neurotigenic and psychotic dynamisms. Part Two deals with the biodynamics of normal and abnormal behavior, including critical comments on psychoanalytic theory and on Meyerian psychobiology, followed by a general biodynamic theory of behavior involved in conflicts, and of their treatment, biodynamic processes of language, and a soul-searching critique of the biodynamic theory of behavior. There are a number of appendices, including an illustrative psychoanalysis of a neurotic personality, psychoanalytic formulations of the psychoses, and principles of group communication.

It may be said in passing that the author's bow in the direction of Meyerian psychobiology is perfunctory, and he shows neither the interest in nor the grasp of psychobiology which he seems to have for psychoanalysis. Critical of the traditional psychoanalytic formulations, he appears to follow the neo-psychoanalytic trends outlined by Alexander, Menninger, Kubie, Rado, and others.

In the biodynamic formulations of behavior, the following general principles are said to actuate behavior:

1. Behavior is basically actuated by the physiologic needs of the organism and is directed toward the satisfaction of those needs.
2. Behavior is contingent upon, and adaptive to, the organism's interpretations of its total milieu as based on its capacities and previous experiences.

3. Behavior patterns become deviated and fragmented under stress, and when further frustrated, tend toward substitutive and symbolic satisfactions.
4. When, in a given milieu, two or more motivations come into conflict, in the sense that their accustomed consummatory patterns become partially or wholly incompatible, kinetic tension (anxiety) mounts and behavior becomes hesitant, vacillating, erratic, and poorly adaptive (neurotic), or excessively substitutive, symbolic, and regressive (psychotic).

There is an extensive bibliography designed to indicate important references with which medical students should be acquainted, and a glossary of psychiatric and psychoanalytic terms.

This is an interesting book, yet one rather hard to read, because of the author's predilection for big words when little ones would do just as well. A staggering number of references to the literature leads to the conclusion that this book is a veritable tour de force. The author made a great deal of the fact that psychobiologists are said to have invented a terminology too difficult for most people to bother with. He ignores the fact that it is psychoanalysis, and not psychobiology, which has burdened the language with new terms, and this text, while further burdening the language with only one new word, "biodynamic," uses language in such a way as to scare off even interested readers.

WENDELL MUNCIE

TREATMENT BY ION TRANSFER (*Iontophoresis*).

By D. Abramowitsch and B. Neoussikine. Grune & Stratton, New York. $4.50. xii + 186 pp. 1946.

This book furnishes a comprehensive survey of the subject of iontophoresis, including an excellent bibliography. This method of treatment is one which has been much neglected in recent years, yet it is good to remember that it offers certain worth-while possibilities for the local treatment of disease by electrolyte introduction of clinical substances. There is not, apparently, in the literature much critical evaluation of the results of such treatment, and the writers whose views are summarized rely extensively upon rather vague clinical impressions of improvement. This, however, only serves to demonstrate that an interesting field for properly controlled research lies open to the investigator, and the authors are to be congratulated upon the manner in which they have set forth the available data. They express the hope that their book will serve as a basis for further study and utilization of the method. They will certainly deserve the warm thanks of anyone who sets out to explore the field, and it is to be hoped that they will stimulate some to do so.

C. H. ROGERSON

HYPNOANALYSIS.

By Lewis R. Wolberg; foreword by A. Kardiner. Grune & Stratton, New York. $4.00. xviii + 342 pp. 1945.

In these times of rising interest in short-term therapy and of recent attention to various hypnotic techniques, there is a welcome for Lewis Wolberg's *Hypnoanalysis*. This text combines both issues with remarkably effective results and stimulates desire for further work along these lines, work which might well follow many of Wolberg's own suggestions for possible research. In its first part, the text is devoted to his work with a patient of schizoid personality, with a considerable amount of affective thematic material. The author is to be congratulated for the persistence of his efforts and for the boldness with which he took an active role in dealing with an exceedingly difficult problem, one, in fact, which would not ordinarily be thought suitable for hypnotic therapy. Wolberg is very fortunate indeed in having had as a patient a man who was able to make elaborate notes that could be included in the protocol, much to the reader's benefit in following the therapeutic progress. It would have been of help if Wolberg could have told more about the time elements in this, particularly since the book carries as a theme effective short-term work. The outcome of the work is considered incomplete in the usual analytic terms. However, as Kardiner states in the Foreword, "there is a definite change in the functional organization of the patient," so that in a social sense he returned to an effective life.

The second part of the text deals with the theory and practice of hypnoanalysis. It appears to be an excellently balanced evaluation of the method, taking up with good critical judgment its limitations and potentialities. It is most interesting to see Kardiner's confidence in this work and his ability to handle with discrimination such an approach. As he notes, no doubt other techniques will yield results, but an exploration of this one, with emphasis upon short-term work, may be enlightening. Certainly, further work and improvement in this technique will, with a growing knowledge of psychiatric potentialities not originally recognized, tend to remove much of the fear of the excessively dependent role often thought to be played by the patient. It should also help to delineate its effect upon patients who are concerned with themes of being influenced. This presentation of the subject by Wolberg adds significantly to the present attempts to further short-term psychotherapy.

LUCILLE PRICE

A PSYCHIATRIC PRIMER FOR THE VETERAN'S FAMILY AND FRIENDS.

By Alexander G. Dumas and Grace Keen. The University of Minnesota Press, Minneapolis. $2.00. 214 pp. 1945.

This book grew out of a discussion of how it might be possible to assist Veterans with neuropsychiatric disabilities by helping their families and friends to understand their situation, their difficulties, and their needs. In tackling this task of true "propaganda," Alexander Dumas, a psychiatrist for many years in charge of the nervous and mental section of a Veterans Administration Hospital, has provided most of the information, the case histories, and their interpretations, whereas Mrs. Keen, a writer, has arranged the material, put it in written form, and illustrated the book.

What has come out of this collaboration is indeed a remarkable guide for all who deal with, must get along with, and want to help any veteran, whether he is uninjured, totally or partially disabled for physical reasons, psychotic, or psychoneurotic. The book is vividly written, simple and clear in its arrangement, and the many illustrative case histories, anecdotes, and examples are interesting even for the psychiatrist.

There is no false sentimentality here, but true concern to educate and to bring sufferers back to the road to happiness, even though that means initial hardship, sacrifice, and humiliation.

If the book is accepted in the spirit in which it has been written, if it is read and its advice followed by many—the veterans included—it could indeed be of great help. Certainly it could bridge some of the gaps created by the fact that "the existing facilities and personnel can provide adequate psychiatric treatment for only five per cent of the veterans who need it."

WALTER O. JAHRREISS

THE PHYSIOLOGY OF SEX. *Pelican Books.*

By Kenneth Walker. Penguin Books, New York. 25 cents (paper). 183 pp. 1946.

This is a very good discussion of sex and sexual adjustments. Sexual problems are approached frankly and clearly. More space is given to behavior and problems of adjustment than to the biological aspects themselves. There is an introductory chapter on the biological nature of sex determination and a second on sex differentiation, but to a biologist these hardly more than sketch the subject in broad outline. Walker proceeds at once to a study of the sexual characters, the nature of the sexual impulse and of the sexual act, the sexual impulse in childhood, maturity, and old age, problems of sex and marriage, success and failure in marriage, romantic love, preparation for marriage, divorce, sexual deviations, the social problems created by sex, and the place of sex in education. These are discussed with originality and force. Particularly in taking up the problem created by the postponement of marriage in modern civilization to a later and later age, the author speaks with common sense and wisdom. The book may be recommended to all who desire an introductory consideration of sex and sex problems.

BENTLEY GLASS

UNHAPPY MARRIAGE AND DIVORCE. *A Study of Neurotic Choice of Marriage Partners.*

By Edmund Bergler; with an introduction by A. A. Brill. International Universities Press, New York. $2.50. 167 pp. 1946.

This psychoanalytic study of unhappy marriage and divorce is an excellent exposé of the neurotic factors affecting the love life. The eight chapter headings are as follows: The Enigma of Tenderness in Love; The Neurotic is an Unconscious Repeating Machine; Marriage as a Patent Medicine; The Insistence on Monogamy is Acquired in the Nursery; Sexual Conflict in Marriage; An Attempt at a Classification of Neurotic Marriages; War Marriages; Can Indiscriminate Divorce Be Avoided?

The author makes some statements which are open to question: "Now it cannot be denied that the majority of civilized people today are neurotic, that is, they suffer from an illness of the unconscious and are therefore incapable of love." One may wonder if the author's views on this matter are not projected onto the world from his consulting room. Also: "It cannot be denied, however, that the neurotic who is incapable of tender love, even when his potency is intact, is not a very engaging type. What some neurotics call 'love' is mostly a dreary pursuit of release from sexual tension, which must remain unsatisfactory just because of the absence of tender components. . . .Healthy people have an unerring instinct in detecting these sufferers, and avoid them as sexual objects. It is no accident that the environment of the neurotic is composed entirely of neurotics. The frequent presentation in novels of 'disappointment' in love is therefore clinically incorrect. The healthy woman is just as immune to the man incapable of tenderness, as is the healthy man to the frigid, aggressive woman. But if lovers 'fall for' this type it is because they have a concealed neurosis usually combined with unconscious tendencies to self-torture (masochism)." The author is quite right in his observation that in an unhappy marriage, while one partner alone comes in for treatment, the other partner may be adjudged equally at fault for the unhappy state of affairs. Here again it seems to me he takes the stand usual with Freudians: he denies the possibility of anything but

the most inevitable causality in the choice of partners. How would he explain the not uncommon phenomenon of a break-up of a marriage promptly on the discovery of an intractable impotency, followed by successful remarriage to a healthy partner. I am convinced that plenty of healthy people do not have that unerring instinct which he attributes to them all and that sometimes they only develop that instinct through personal tragedy.

Nevertheless, with these reservations, the book is full of valuable observations on the sex life in marriage, and one may only hope that Bergler's future expectations for psychiatric investigation in every case of divorce proceedings will some day come to pass. He is probably quite right in saying: "I believe that judges in divorce courts of future generations will not grant divorce without asking as prerequisite for the proof that both candidates for divorce were treated psychiatrically, particularly if the couple has children. . . .We may venture the assumption that indiscriminate divorce as practised today will to future generations seem a crude and ineffective device."

WENDELL MUNCIE

UNDERSTANDING OURSELVES.

By Helen Shacter. McKnight & McKnight, Bloomington, Illinois. 60 cents (paper). 124 pp. 1945.

Understanding Ourselves is written with an obvious interest in acquainting the college student, in particular, with some basic knowledge of human dynamic psychology. This object is carried out with illustrations and observations made in the school setting from childhood on. Essentially written with simplicity and attempted directness, it has the inherent danger of such methods. However, this need not be considered detrimental for the college student in his first introduction to such matters. The entire tone is that of a friendly lecture, with the idea of teaching behind it. Thus the structure of the book patterns itself around chapters that begin with "Getting Along With Yourself and Others" and end with "The Game of Living." Photographs made on a college campus are added as illustrative material. All in all, the booklet may be considered a general, friendly help in preliminary orientation for the average student with interpersonal problems.

LUCILLE PRICE

HUMAN BIOLOGY

STRANGE CUSTOMS, MANNERS AND BELIEFS.

By A. Hyatt Verrill. L. C. Page & Company, Boston. $3.75. xiii + 302 pp. 1946.

Verrill deals with such strange aspects of non-western cultures as their methods of dressing and ornamenting the body, their foods, weapons, money, means of communication and transportation, their beliefs in sympathetic magic and amulets, their games and marriage rites, etc. As far as the data are taken from the anthropological literature, they are in general reliable. A great number of them, no less reliable, stems from the author's own observations. A few outmoded anthropological theories (such as marriage by capture, etc.) are occasionally encountered, but this is rather unessential. This honest and unpretentious book does not intend to be a systematic treatise on anthropology. As its title indicates, it aims to report "strange customs" in order to broaden our horizon and to entertain. It does this in a pleasant and interesting way, and so stands far above the usual trashy "popular science." To my mind it is indeed quite as valuable as some of the smug fashionable professional writings which have lost that naive curiosity, interest, love, and respect for "savage" customs that is at the root of all true anthropology.

ERWIN H. ACKERKNECHT

THE EASTERN TIMBIRA. *University of California Publications in American Archaeology and Ethnology, Volume XLI.*

By Curt Nimuendajú, translated and edited by Robert H. Lowie. University of California Press, Berkeley and Los Angeles. $5.00 (cloth); $4.50 (paper). x + 357 pp. + 2 maps. 1946.

Curt Nimuendajú, who was originally Curt Unkel from Jena, in Germany, died in 1945 amongst the Brazilian Indians whom he had studied and helped with incomparable zeal and intelligence for 40 years. The present monograph deals with the Eastern Timbira, a cluster of tribes inhabiting the steppes of Central Brazil, south of the Amazonas. Most of the details were collected among the Ramkokamekra tribe, with whom the author stayed for several months each year from 1929 to 1936. The book is built along the traditional divisions into history, ecology, social life, ceremonialism, religion and magic, myths and tales. It is one of the richest ever published in South American ethnography, and contains most interesting details about agriculture, the equality of the sexes, institutional friendship, initiation ceremonies, sports, cultural change, etc., among the Eastern Timbira. The value of the book consists not only in the facts reported, but in the strong and wise personality of the teller that shines everywhere through the somewhat schematic presentation. The translator, himself an eminent creative writer in anthropology, has made a big sacrifice of his time, but his object was worth

the trouble, and the result of his labors is extremely satisfactory.

ERWIN H. ACKERKNECHT

JUNGLE JOURNEY.

By Jo Besse McElveen Waldeck; illustrated by Kurt Wiese. The Viking Press, New York. $2.50. 255 pp. 1946.

The journey described is a trip to the upper reaches of the Cuyuni River of British Guiana for the purpose of investigating the customs of the Indians there, as well as collecting materials of ethnological and zoological value. The story of the daily incidents of this trip is told in an easy, modest way that nevertheless leaves one admiring Mrs. Waldeck for the ability she showed in meeting the hardships that accompany such an undertaking.

While the story makes fairly interesting light reading, the treatment of observations upon the Indian and animal life of the region is too superficial to be recommended for anyone seeking accurate information. In addition, a note of triteness may be detected in Mrs. Waldeck's veneration of the jungle ways of the savages that tends to lessen the force of the latter part of the story.

The illustrations by Kurt Wiese are numerous and pleasing, excepting only that of two manatees achieving seemingly impossible feats of buoyancy for such clumsy and heavy aquatic mammals.

JOHN E. CUSHING

PEASANT LIFE IN CHINA: *A Field Study of Country Life in the Yangtze Valley.*

By Hsiao-Tung Fei, with a preface by Bronislaw Malinowski. Oxford University Press, New York. $3.50. xx + 300 pp. + 14 plates. 1946.

Writing the introduction to this study before the war, Malinowski said, "I venture to foretell that *Peasant Life in China* by Dr. Hsiao-Tung Fei will be counted as a landmark in the development of anthropological field-work and theory. . . . Our attention here is directed not to a small, insignificant tribe, but to the greatest nation in the world. . . . It is the result of work done by a native on natives. . . . Though it takes in the traditional background of Chinese life, [it] does not remain satisfied with the mere reconstruction of the static past. It grapples fully and deliberately with . . . the transformation of traditional culture under Western impact." At the same time Sir Denison Ross, one of the world's experts in Oriental Studies, said, "I know of no other work which describes at first hand and with intimate understanding the full story of life in a Chinese village community." That was in 1938. War came, and an American edition of the book was long delayed. Then, by striking coincidence, there appeared from the press, just a few months before Fei's book was issued, the parallel study by Martin C. Yang of *A Chinese Village*, which was reviewed in these columns in June of this year (Q.R.B. 21: 215).

The two books complement one another to a very full degree. Yang shows the result of American training in sociology, Fei the result of British training in anthropology. Yang writes in a free style and introduces the personal element; Fei writes in formal anthropological style and is almost completely impersonal. Yang writes of a Shantung village in the wheat, millet, sweet potato region of north China; Fei, of a village on the Yangtze plain, subsisting on rice growing and silk culture. Yang's village is still little touched by Western economic influences, but much by Western education and Christianity. Fei's village is little changed in education and religion, but profoundly affected by the influence of the West on the silk industry. The Kuomintang party and the governmental changes of the New China have little modified the Shantung village, but the other, close to Shanghai, has experienced the growth of a cooperative silk factory and reorganization of the political units and subunits of immediate importance to the people. The Shantung village is near the sea-coast, yet inland on a small stream; transportation is on foot, by donkey and mule, and by cart. The Yangtze village is near an inland lake, in a land abundantly supplied with streams and canals; transportation is predominantly by boat.

In spite of contrasts such as these, the similarities between the two Chinese villages are far more numerous than the contrasts. The tie to the land, the problems of inheritance and division of the patrimony, the men who work the land, and the landlords, the subjection of individual to family, the basic social unit—the Chia, or expanded family, the significance of the ancestors and the kitchen gods, of the obligation of the young to the old, kinship and marriage relations, food and money income—all of these, and many other characteristics of the villages, are so profoundly alike that the two accounts mutually strengthen one another to perfection.

Only those who have lived in China many years, perhaps only those who have known it from childhood, can fully appreciate the depth of perception marking these two applications of scientific method to the oldest culture in the world. But to all those who read there will surely come a realization of the great strength of that culture, which through the cataclysms of wars and civil strife promises the regeneration of the China still to emerge.

BENTLEY GLASS

ANATOMY OF RACIAL INTOLERANCE. *The Reference Shelf, Volume 18, Number 5.*
Compiled by George B. de Huszar. The H. W. Wilson Company, New York. $1.25. 283 pp. 1946.

This is a collection of thirty-two non-technical articles on racial intolerance, which have been culled from scientific, educational, and general journals and magazines. The authors include many well-known anthropologists, sociologists, and educators, including, among others, Robert Redfield, W. M. Krogman, Hortense Powdermaker, Wm. Heard Kilpatrick, Malcolm Ross, Gordon Allport, Robert J. Havighurst, Clyde R. Miller, Margaret Mead, Harry L. Shapiro, and H. M. Kallen. All are in essential agreement as to the nature and origins of racial prejudice and intolerance, the growing need for action to minimize them, and even the character of the remedies that offer hope. In view of all these things, the book ought to be an interesting and valuable one. Yet no such unreserved recommendation can be given it. An inordinate amount of dull repetition of trite and obvious conclusions kills the reader's enthusiasm ere long. There are some very good contributions, but these barely overcome the boredom induced by a succession of poor ones enough to carry the reader on to the next really good paper.

The nadir was reached with a paper by Abraham I. Katsh that dealt with the remarkable effects of a course on "Racial Contributions to American Culture" taught at New York University. A poorly framed questionnaire, answered by 2000 students, ten per cent of whom had taken the course, was analysed into percentages of those indicating discrimination against particular national, religious, or racial groups. Quite aside from the dubious statistical significance of the differences between the large group of students who had not taken the course and the small group who had, it does not appear to have occurred either to Katsh, or to the editor of the *Educational Forum*, in which the article first appeared, or to de Huszar, who selected it for inclusion in this collection, that there might be some ground for supposing that the students who elected this course were probably those who were least intolerant in such matters to start with.

It is a welcome relief to turn from this bungling analysis to a straightforward discussion of hopeful signs in race relations in America, written by Lester B. Granger of the National Urban League. Yet in the end, even an ardent champion of human rights and individual worth must conclude that as a whole this book has in it too much of the dry bones of anatomy and the dust of analysis and far too little of the heart-blood and soul-fire that inspire and kindle to action.

BENTLEY GLASS

THE CULT OF EQUALITY. *A Study of the Race Problem. By Stuart Omer Landry. Pelican Publishing Company, New Orleans.* $3.50. xv + 350 pp. 1945.

The central theme of this book is the lowly hereditary endowment of the Negro and the dangers involved in any scheme for equalizing opportunities that might increase the chances of crossing with the superior Caucasians. One gets the impression that the author sincerely undertook an objective analysis of this matter but was quite unable to do it. Instead, the book gives a rather complete picture of the preconceptions and prejudices which have grown up around the problem, covered over with a thin veneer of anthropological and economic "facts and figures" along with a liberal sprinkling of quotations, ranging from the considered opinions of present-day men of science to anecdotes written in the last century.

Landry is obviously a widely read man, but he just as obviously lacks the ability to evaluate critically what he has read, at least in this field. Any evidence that can be construed to indicate a low degree of inherent mental ability in the Negro is pounced upon with delight, any which opposes this view is, if included, glossed over as rapidly as possible. In several cases, it is coupled with some unsupported anecdote that tends to belittle the evidence and put the Negro in an unfavorable and slightly ridiculous light. Much statistical material is given, but little of it really proves anything. Landry's interpretations of data are generally naively simple, without any indication that he recognizes the complexities involved. If he has any acquaintance with modern genetics, he has managed to hide it very well. It is true that the word "gene" appears once, but otherwise his discussions are based upon the old idea of blending inheritance, of the mixing of blood. Unfortunately, because of its readable style, this book may have some influence, especially among those who are already somewhat biased in favor of its main theme.

R. F. KIMBALL

A NEGRO'S FAITH IN AMERICA.
By Spencer Logan. The Macmillan Company, New York. $1.75. viii + 88 pp. 1946.

This is a frank and courageous book, a confession of shortcomings as much as a charge of unfair discriminations, a better expression of our hopes for a really democratic United States of America than the bitterness, however justified, of some writers on the condition of the Negro in America, or the sociological moralizing of others. The author was a Negro soldier during the war and served both in Europe and on Okinawa. He was unable to continue in college more than one year because of the loss of his savings in a bank failure. He has met injustice and discrimination in his business career. But no experience has soured him, since he is

himself tolerant and fair-minded. His analysis of race relations is therefore well worth the hour or so it will take to read it. He holds fast to his faith in America because he is a real American himself.

BENTLEY GLASS

SOUTHERN HORIZONS.

By William Haynes. D. Van Nostrand Company, New York. $2.75. xiii + 316 pp. 1946.

Haynes is a chemist, and he believes the chemical age is here to stay. Also, he is impressed by the fact that no section of the country is so blessed with chemical raw materials as the South. In this regional study, called *Southern Horizons*, we learn of Southerners who are looking forward, and not backwards. In this account of various chemical wonders, we find men growing cottonless cotton plants, and others bombarding the atoms in natural gas to get undreamed of by-products. Haynes also describes the future vistas of the Textile School of the University of North Carolina, the new cooperative Southern Research Institute, and other enterprises. He writes with much enthusiasm and presents, very interestingly, the progress that is being made in helping the South to make the most of its opportunity to become a vital part of our nation.

Haynes recognizes the faults of the government's farm economy program. The great crop of the South is cotton and the government's cotton program, in its causes, methods, and in the ends sought, he believes to be all wrong. This program has only tended to keep poor land and incompetent farmers in production.

A mere mention of the economic aspects of the South's problem is Haynes's gravest fault and the reason for a book from his pen that is only second-rate. Being zealous about opportunity is commendable, but to paint only in rosy hues and to gloss over a serious situation that must be met first is foolhardy.

E. H. HERRON

POPULATION AND PEACE IN THE PACIFIC.

By Warren S. Thompson. University of Chicago Press, Chicago. $3.75. 397 pp. 1946.

This is a scholarly, factual treatise on the population density and growth, and on the natural resources, economic conditions, and political outlook of the many countries in the vast areas of the Pacific and southern Asia. Since the book also pleads for a better managed future for the people of this part of the globe, it is argumentative to some degree. It should be read by everyone interested in international affairs and in the future of mankind. Primarily a welcome reference work for statesmen and students of national economy, history, and geography, it contains also a great deal that concerns biologists, since the vital facts of human population growth play a prominent part in the discussion.

The acquisition of erect posture and its many associated bodily changes have undoubtedly been the earliest determining factors in the evolution of man. This must have been quickly followed, or even accompanied by, the unique development of man's central nervous system. Very much later man became further specialized by the great prolongation of his postnatal growth period. As a fourth, very recent and possibly most decisive, major evolutionary specialization we have to recognize the phenomenally rapid increase in human population that necessitates changes in social and international relations far beyond what has occurred so far. According to the best estimates the world contained few more than 900 million human beings in 1800, but to-day there are well over 2,000 million human inhabitants, many groups increasing at a shocking rate and more than half already residing in Asia.

Warren Thompson, unlike many national leaders, is fully aware of the fact that this continuing increase is deplorable and will inevitably lead to lowered standards of living and wide-spread fratricide. He shows convincingly that "It is time we recognized the very obvious fact that the present differentials in population growth in the world are working against Europe, west of Poland and the Balkans, and in favor of Eastern Europe and Asia." There are no more new continents to settle, and the improvement and spread of modern agricultural methods and of industrialization offer hope for only local and temporary solutions of population problems which are bound to become more pressing every year, especially in the northern part of the Pacific area. The author advocates opening up the colonies and tropical lands in general to the surplus humanity of southern Asia. This would alleviate conditions in the near future, but the only permanent remedy is prevention of population pressure from uncontrolled population growth by means of birth control.

A selected bibliography of over 500 titles and an adequate subject index add to the value of this timely volume.

A. H. SCHULTZ

DE OMNIBUS REBUS ET QUIBUSDEM ALIIS

GERMAN FOR THE SCIENTIST (*Chemist and Physicist*).

By Peter F. Wiener; with an introduction by E. N. da C. Andrade, with additional sections and foreword by Paul Spoerri. Chemical Publishing Company, Brooklyn, New York. $3.50. xxi + 238 pp. 1946.

A book of this kind has long been needed by the graduate student in the sciences who is facing the requirement of a reading knowledge of scientific German. Although wholly limited to physics and chemistry, the

book will have considerable value for the student of the biological sciences, inasmuch as the German chemical vocabulary, in particular, is a "must" of aggravated difficulty for him.

Part I consists of six lessons covering the essentials of German grammar with astonishing brevity and comprehensiveness. This is followed by appendices summarizing the declension of nouns, articles, personal pronouns, and adjectives; the conjugation of verbs; irregular verbs; prepositions and the cases they govern; German abbreviations; simple scientific compositions in German; a translation of the story of "The Little Matchgirl," by Hans Christian Andersen, which is used throughout the six lessons as material; and the gothic German alphabet. This entire part of the book, including the appendices, occupies only 51 pages. Yet it appears entirely adequate for the purpose, which Spoerri, in an Introduction to the American edition, aptly describes as the development of "the ability to extract the essential meaning of a scientific text without too much waste of time." The high standards of the scholar of literature and the philologist are not necessary for this.

The remainder of the book is devoted to selections from the writings of great modern German chemists and physicists: Julius Schmidt, Freundlich, Ruzicka, Willstätter, Kuhn, Max Born, Abbe, Einstein, Nernst, Planck, Hertz, and others. There are 18 selections from the field of chemistry and 14 from that of physics. At the end of the book, in Part IV, a translation of each of these selections is given, along with 34 pages of German-English vocabulary.

The idea of introducing the fairly advanced student to a foreign language through the means of selections from the work of the great scientists he knows and admires is excellent pedagogy. Biologists, too, will enjoy these selections from physics and chemistry, and hope that someone will ere long prepare the same sort of a book for the biological sciences themselves.

This book was written in England before the war, but was first published only after four years of it had passed.

BENTLEY GLASS

SCIENCE NEWS. I.

Edited by John Enogat. Penguin Books, Harmondsworth, Middlesex, England; and New York. 1 shilling (paper). 208 pp. + 8 plates. 1946.

Like *New Biology, I*, reviewed recently in this journal (Q.R.B. 21: 74. 1946), this is the first number of a proposed series of very inexpensive but authoritative articles on recent scientific advances. This series begins very auspiciously. This number contains articles by K. V. Thimann on Growth Hormones in Plants, by Geoffrey Gorer on Japanese Character, by Sir Lawrence Bragg on Metals, by D. D. Eley on Catalysis, by Eric M. Crook on the Electron Microscope, by John Enogat on Allergy, and by Eric Kraus on Physics of the Atmosphere. In addition, there are a number of unsigned contributions covering a variety of topics: the photographic plate, cancer, detergents, D.D.T., color vision, social ranking in farmyard poultry, sex hormones and rhythms, colchicine, vitamin bioassays, antibodies, aviation medicine, new drugs, antihistamines, reading, grafting legs on rats, uses of seaweed, lignin, synthetic rubber, and a brief section aptly headed Curiosities. Every buyer will get far more than his money's worth. It is to be hoped that the series will be readily available in America as well as Great Britain.

BENTLEY GLASS

STUDIES IN SCIENCE. *The University of North Carolina Sesquicentennial Publications.*

Edited by W. C. Coker. The University of North Carolina Press, Chapel Hill. $3.00. x + 375 pp. + 12 plates. 1946.

One is frankly nonplussed by such a volume as this. Beautifully printed and illustrated, its subject matter is so varied and so technical in nature that few scientists, let alone laymen, will find more than one or two contributions of interest to them. For whom is such a book prepared? The most reasonable answer seems to be that it is chiefly designed to enhance the prestige of the university celebrating a notable anniversary.

The thirty-one contributions include four dealing with chemistry, four with mathematics, and one with physics, the remainder being scattered in biological fields. These are entitled:

Penicillin: V. Mycological Aspects of Penicillin Production, by K. B. Raper and Dorothy F. Alexander; Nutritional Studies of Representatives of Five Genera in the Saprolegniaceae, by Alma J. Whiffen; Revision of the Genus Coelomomyces, Parasitic in Insect Larvae, by J. N. Couch; Studies on the Absorption and Metabolism of Quinine and Related Problems, by J. C. Andrews and G. C. Kyker; Dark-field Microscopy of Surface Phenomena in Phospholipid Films and in Formed Elements of Blood and Bone-marrow, by J. H. Ferguson; Regeneration of Lymphatic Channels Following Ablation of Lymph Nodes, by R. L. Holman; The Cytological Reaction to Injury of the Glomerulus of the Opossum Kidney (Didelphys virginiana), by W. deB. MacNider; Parathyroid Cyst, by R. B. McKnight; Blood Volume Changes following Acute Hemorrhage, by A. T. Miller; The Role of the Fibroblast in Acute Inflammatory Reactions with Reference to Phagocytic Exudate Cells, by E. C. Pliske; The Venereal Disease Problem in the United States in World War II, by W. L. Fleming; Immunity Relations in Human Cestode Infections, by J. E. Larsh, Jr.; Average Dietary Intakes in Two North Carolina Rural Counties, 1940 and 1944, by D. F. Milam; Experimental Drug Plant Culture in North Carolina, by E. A. Brecht and H. M. Burlage; The Assay of Nux Vomica Preparations by Chromatographic Meth-

ods, by J. LaRocca and H. M. Burlage; A Comparative Study of Toluene and Xylene in the Determination of Moisture in Vegetable Drugs by the Distillation Method, by C. K. Wheeler and M. L. Jacobs; The Environmental Factor in Sexual Inversion, by H. W. Crane; A Factorial Analysis of the Role of Shock in Brightness Discrimination Learning, by R. J. Wherry and D. Rethlingshafer; Studies of Response Generalization in Conditioning. III: Stimulus Variation as a Factor in Response Generalization, by D. D. Wickens; The Encystment Process in the Ciliate Didinium nasutum, by C. D. Beers; Segregation of Oöplasmic Constituents, by D. P. Costello; On Homoeosis in Drosophila, by C. A. Villee.

As may be seen from the contents listed, there is much of special interest and value to be found here. Nevertheless, scientists will certainly deplore this trend on the part of some institutions to bury original scientific contributions in such pot-pourri. For any individual, the cost of the volume must be entirely incommensurate with the value of the one or two contributions that will be sought. In an institutional library, the articles will be lost for lack of separate listing in catalogs and indexes. *Quo bono?*

BENTLEY GLASS

MADAME CURIE: *A Biography.*

By Eve Curie; translated by Vincent Sheean. Pocket Books, New York. 25 cents (paper). x + 450 pp. 1946.

There are only a few biographies of scientists the equal of this one, first printed in this translation in 1937. The fund of inspiration and understanding of the scientific spirit a young student of biology (or an old one, either) may draw from such a masterpiece cannot be measured at all by the hours spent in reading it. With Vallery-Radot's *Pasteur* and Geoffrey West's *Darwin* let it be required of all!

Perhaps it should be mentioned that the reader may be irritated, when reading these unsewn pocket books, by having leaves come loose. This is especially frequent with the fatter volumes. Still, at 25 cents, even a student can afford a second copy.

CARNEGIE INSTITUTION OF WASHINGTON YEAR BOOK NUMBER 44, *July 1, 1944—June 30, 1945: With Administrative Reports through December 14, 1945.*

Carnegie Institution of Washington, Washington, D. C. $1.50 (cloth); $1.00 (paper). xxxiv + 196 pp. 1945.

The current report of the Carnegie Institution shows a gradual return from wartime conditions to a normal activity. Workers on leave in military service are returning, and war research projects are being terminated. The favorable financial position of the Institution, due largely to war conditions and amounting to an excess of income over expenditures, in the year ended October 31, 1945, of close to half a million dollars, will possibly alter considerably as normal expenditures mount. Yet the report gives evidence of a vigorous, healthy foundation supporting scientific work of the highest order.

The reports of the Division of Plant Biology, of the Department of Embryology, of the Department of Genetics, and of a number of special projects clearly show the scope of the work being carried on in the biological sciences. One branch, the Nutrition Laboratory at Harvard University, is being closed after a long and productive history that began in 1907 with Francis G. Benedict as Director. In the other branches, most projects are continuations of work begun in earlier years. At Stanford University further work on chlorellin, a promising antibiotic, has been pressed, and the rangegrass program has resulted in the production of several bluegrass (*Poa*) hybrids that combine the dry region adaptation of one parent species with the rust resistance and rhizome growth habit of the other, etc. The cooperative work in embryology at Baltimore has progressed without interruption. More very early human embryos have been recovered, and additional efforts to fertilize and culture human eggs *in vitro* were attempted. The fate of the theca interna in the sow has been finally determined and Margaret Reed Lewis has found that in rats the transplantability and growth after transplantation of sarcomata vary with the genetic strain of the recipient. At Cold Spring Harbor, Barbara McClintock has continued to analyse the special genetic mechanisms responsible for the induction of mutations in the short arm of chromosome 9 in maize, and also reports on her work with the chromosomes of *Neurospora*. Warmke has successfully concluded his brilliant analysis of the mechanism of sex determination in *Melandrium*. Demerec and Luria studied quantitatively the induction of mutations to phage resistance in the bacterium *E. coli*, by means of x-rays and ultraviolet rays. Highly important work was carried through on the production by mutation of bacterial resistance to penicillin, sulfonamides, inorganic salts, bacteriophages, or ultraviolet radiation. A high-yielding strain of *Penicillium* was developed by x-ray induced mutation in that organism. Aerosols were tried for chemical induction of mutation in *Drosophila*. Kaufmann has carried out fundamental researches on x-ray induced chromosomal rearrangements, spontaneous mutation rate, and chromosome breakage and rearrangement in *Drosophila*. Dobzhansky has continued his studies of wild populations of *D. pseudoobscura* and has studied interspecific hybridization in an ingenious new type of population cage. MacDowell's studies of mouse leukemia have now extended to the effects of steroid hormones, analysis of modified behavior syndromes, and chromosomal effects. A final report from Riddle and his group of workers on their

endocrine studies in pigeons brings to a conclusion that well-known project. Reports from T. H. Morgan, A. H. Sturtevant, and L. V. Morgan on genetic findings, and from H. C. Sherman on nutrition represent the special projects supported by the Carnegie Institution.

The wealth of detailed results and of preliminary summaries of work in progress given in it make this Year Book a source no biologist should overlook.

BENTLEY GLASS

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION. *Showing the Operations, Expenditures, and Condition of the Institution for the Year Ended June 30, 1944. Publication 3776.* *United States Government Printing Office, Washington.* $1.50. ix + 503 pp.; 40 plates; 1 map. 1945.

The always interesting *Annual Report of the Smithsonian Institution* offers many items of interest in the reports on the U. S. National Museum, the National Gallery of Art, the Freer Gallery of Art, the Bureau of American Ethnology, National Zoological Park, Astrophysical Observatory, and other branches of the institution. For example, geneticists and mammalogists will be interested in the birth at the zoo of a still-born cub to the pair of hybrid Polar-Alaska brown bears. This is an instance of possibly fertile intergeneric hybrids, rare among mammals.

The appendix contains the customary excellent and varied group of semi-popular scientific articles, twenty-three in number this year. Of these, thirteen may be classed as biological: Human limits in flight, by B. H. C. Matthews; Woods and trees—philosophical implications of some facts of science, by F. H. Krecker; Biology and medicine, by A. C. Chandler; The locust plague, by B. P. Uvarov; The codling moth, by B. A. Porter; Grassland and farmland as factors in the cyclical development of Eurasian history, by J. R. Smith; Southern Arabia, a problem for the future, by C. S. Coon; The New World paleo-Indian, by F. H. H. Roberts, Jr.; Easter Island, by Alfred Métraux; Brain rhythms, by E. D. Adrian; The development of penicillin in medicine, by H. W. Florey and E. Chain; Recent advances in anesthesia, by J. C. Krantz, Jr.; and Aspects of the epidemiology of tuberculosis, by L. W. Parr. Authoritative, non-technical, and highly interesting accounts! It is doubtful that any equally good collection of general articles can be obtained elsewhere for twice the price of this annual volume.

BENTLEY GLASS

INDEX

Abrahamsen, David, Men, Mind, and Power, 318
Abramowitsch, D., and Neoussikine, B., Treatment by Ion Transfer (Iontophoresis), 419
Abrams, P. D., Fundamentals of Social Calamity, 124
Acanthodians, 46
Ackerknecht, E. H., Malaria in the Upper Mississippi Valley 1760–1900, 106
ADAMS, A. ELIZABETH, Variations in the Potency of Thyrotrophic Hormone of the Pituitary in Animals, 1–32
Adrenal states, and thyrotrophin, 15
Adriani, John, The Chemistry of Anesthesia, 301
Age, and variations in thyrotrophin, 7
Alexander, Franz, and French, Thomas Morton, Psychoanalytic Therapy, 417
Alexander, J. (ed.), Colloid Chemistry, VI, 302
Alexander-Jackson, Eleanor, A Hitherto Undemonstrated Zoogleal Form of Mycobacterium Tuberculosis, 106
Allen, Arthur A., The Golden Plover, 386
Allen, W. E., Seasonal Occurrence of Marine Plankton Diatoms off Southern California in 1938, 75
Vernal Distribution of Marine Plankton Diatoms Offshore in Southern California in 1940, 183
Allison, Samuel D., and Johnson, June, VD Manual for Teachers, 307
Altenburg, Edgar, Genetics, 79
American Philosophical Society, Proceedings Vol. 89, No. 4, 219
Reports on Scientific Results of the United States Antarctic Service Expedition 1939–1941, 131
Amsden, John Page, Physical Chemistry for Premedical Students, 281
Anaspids, 39
Andrews, Roy Chapman, Meet Your Ancestors, 185
ANIMAL MORPHOGENESIS (book reviews), 196, 293, 388
ANIMAL MORPHOLOGY (book reviews), 95, 197, 295, 391
ANIMAL NUTRITION (book reviews), 97, 201, 301, 398
ANIMAL PHYSIOLOGY (book reviews), 96, 200, 297, 392
Aortic glomus, 333
Appendix, vermiform, epithelioneural associations in, 336
Arcieri, John P., The Circulation of the Blood, 297
Aronson, Lester R., and Noble G. Kingsley, The Sexual Behavior of Anura, Part 2, 394
Arthrodires, 50
Aschner, Bernard, Treatment of Arthritis and Rheumatism in General Practice, 407
Ash, J. E., and Spitz, Sophie, Pathology of Tropical Diseases, 305
Assay, of thyrotrophin, 2
Astasiidae, 264
Ault, James P. *et al.*, The Work of the Carnegie and Suggestions for Future Scientific Cruises, Oceanography—IV, 276

Bacon, J. S. D., The Chemistry of Life, 99
Baillif, Ralph N., and Kimmel, Donald N., Structure and Function of the Human Body, 296
Baitsell, George A. (Ed.), Science in Progress, IV, 132
Baker, John R., The Discovery of the Uses of Colouring Agents in Biological Micro-Technique, 81
Science and the Planned State, 182
Baker, Rachel, Dr. Morton: Pioneer in the Use of Ether, 307
Baldacci, E., La resistenza delle Piante alle Malattie, 381
Barbour, Thomas, A Naturalist's Scrapbook, 368
Barclay, Alfred E., *et al.*, The Foetal Circulation, 390
Bartlett, T. L., How to Look at Birds, 194
Barton, Lela V., Respiration and Germination Studies of Seeds in Moist Storage, 87
Bartsch, P., Schistosomophora in China, 291
Bassler, R. S., and Moodey, Margaret W., Bibliographic and Faunal Index of Paleozoic Pelmatozoan Echinoderms, 278
Bates, Ralph S., Scientific Societies in the United States, 130
Bateson, Wm., 348
Bayne, C. S., Getting to Know the Birds, 193
Beals, Ralph L., Ethnology of the Western Mixe, 127
Beals, Ralph L., *et al.*, Archaeological Studies in Northeast Arizona, 127
Beaver, William C., Laboratory Outlines of General Biology, 183
Beck, Samuel J., Rorschach's Test. II. A Variety of Personality Pictures, 210
Beer, G. R. de, 352
Benard, H., *et al.*, Exposés Annuels de Biochimie Médicale, 400
Benbrook, Edward A., List of Parasites of Domesticated Animals in North America, 291
Benedict, Ruth, Patterns of Culture, 211
Bennett, John W., Archaeological Explorations in Jo Daviess County, Illinois, 214
Bensley, B. A., Practical Anatomy of the Rabbit, 197
Bergler, Edmund, Unhappy Marriage and Divorce, 420
Bernhardt, Karl S., Practical Psychology, 411
Bicknell, Franklin, and Prescott, Frederick, The Vitamins in Medicine, 399
Binger, C. A. L., *et al.*, Personality in Arterial Hypertension, 311
Binger, Carl, The Doctor's Job, 205
Bingham, Marjorie T., The Flora of Oakland County, Michigan, 83
BIOCHEMISTRY (book reviews), 99, 202, 301, 400
Biometrics Bulletin, 130
BIOMETRY (book reviews), 128, 216, 323
Bird, Junius B., Archaeology of the Hopedale Area, Labrador, 214
Birds galliformes, 161
phyletically above galliformes, 168
phyletically below galliformes, 172
populations and predation, 161

Bisby, G. R., An Introduction to the Taxonomy and Nomenclature of Fungi, 185
Bisch, Louis E., Your Nerves, 121
Blackwelder, R. E., Checklist of the Coleopterous Insects of Mexico, Central America, the West Indies, and South America, Part 3, 91
Blood, The Journal of Hematology, 96
Blough, Glenn O., Animals and Their Young, 73
Animals that Live Together, 73
Birds in the Big Woods, 73
The Pet Show, 73
Useful Plants and Animals, 73
Blough, Glenn O., and DePencier, Ida B., How the Sun Helps Us, 73
Boas, Franz, Race and Democratic Society, 211
Bobwhite quail, 161
Bogert, Charles M., and Oliver, James A., A Preliminary Analysis of the Herpetofauna of Sonora, 92
Boivin, André, Bactéries et Virus, 402
Bonham, H. J., Aids to Botany, 81
Bonin, G. von, Cortex of Galago, 95
Borden, Charles A., Oceania, 216
Boring, Edwin G. (Ed.), Psychology for the Armed Services, 412
Bowers, Edwin F., Know Your Prostate, 406
Boyd, William, An Introduction to Medical Science, 115
Brachet, Jean, Embryologie Chimique, 388
Brain, W. Russell, and Strauss, E. B., Recent Advances in Neurology and Neuropsychiatry, 206
Brand, T. von, Anaerobiosis in Invertebrates, 281
Brandt, Herman F., The Psychology of Seeing, 118
Brederick, Hellmut, and Mittag, Robert, Vitamine und Hormone, Part I, 300
British Paediatric Association, Report on the Incidence of Rickets in War-Time, 106
Britton, Max E., A Catalog of Illinois Algae, 84
Brody, Samuel, Bioenergetics and Growth, 97
Bronson, Wilfrid S., Turtles, 92
Broster, L. R., Endocrine Man, 201
Brown, Earle B., Optical Instruments, 218
Bruère, Martha Bensley, Your Forests, 188
Brues, Charles T., Insect Dietary, 383
Buck, Frank, and Fraser, Ferrin, Jungle Animals, 387
Burch, Guy Irving, and Pendell, Elmer, Population Roads to Peace or War, 128
Burnet, Frank MacFarlane, Virus as Organism, 203
Burrows, H., Biological Actions of Sex Hormones, 299, 324
Burton, E. F., and Kohl, W. H., The Electron Microscope, 324
Bush, Vannevar, Endless Horizons, 366

Cable, Emmett James, *et al.*, Science in a Changing World, 324
Campbell, Arthur S., and Clark, Bruce L., Miocene Radiolarian Faunas from Southern California, 77
Radiolaria from Upper Cretaceous of Middle California, 77
Campbell, John D., Everyday Psychiatry, 315
Cannon, Walter B., and Field, Richard M., International Relations in Science, 365
Cannon, W. B., The Way of an Investigator, 72
Carmichael, Leonard (Ed.), Manual of Child Psychology, 412
Carnegie Institution of Washington, Contributions to Embryology, Vol. XXXI, Nos. 198 to 206, 294
Year Book 44, 426
Carnivores, 159
Carotid glomus, 331
Carter, George F., Mainsprings of Civilization, 178
Carter, George F., Plant Geography and Culture History in the American Southwest, 212
Caullery, M., Biologie des Jumeaux, 196
Cephalaspids, 35, 355
Chadwick, Henry D., and Pope, Alton S., The Modern Attack on Tuberculosis, 408
Chaney, Ralph W. (Ed.), Pliocene Floras of California and Oregon, 374
Chauvin, Rémy, La Vie de l'Insecte, 383
Chideckel, Maurice, The Romance of Human Architecture, 199
Chidester, F. E., Nutrition and Glands in Relation to Cancer, 109
Chloroplasts, of euglenoids, 253
Chondrichthyes, 33, 34, 56, 65
Chordates, fish-like, (see Ostracoderms, Placoderms)
Christensen, Clyde M., Keys to the Common Fleshy Fungi, 380
Clark, Bruce L., and Campbell, Arthur S., Eocene Radiolaria from the Kreyenhagen Foundation Near Los Banos, California, 77
Clark-Kennedy, A. E., The Art of Medicine in Relation to the Progress of Thought, 211
Coca, A. F., Familial Nonreaginic Food-Allergy, 408
Coccygeal glomus, 333
Coker, W. C. (Ed.), Studies in Science, 425
Colaciidae, 264
Colbert, Edwin H., The Dinosaur Book, 278
Conard, Henry S., How to Know the Mosses, 186
Condra, G. E., and Elias, M. K., Study and Revision of Archimedes (Hall), 276
Contractile vacuole, of euglenoids, 249
Cooper, Gerald P., and Fuller, John L., A Biological Survey of Moosehead Lake and Haymock Lake, Maine, 74
Cooper, Lane, Louis Agassiz as a Teacher, 182
Courrier, Robert, Endocrinologie de la Gestation, 395
Cousins, Norman, Modern Man Is Obsolete, 122
Cow, epithelioneural associations in, 338, 339
Craig, G. S., and Beatrice D. Hurley, Exploring in Science, 369
Craig, G. S., and Katherine E. Hill, working with Science, 369
Craigie, E. Horne (Ed.), Practical Anatomy of the Rabbit, 197

Crandall, Julie V., The Story of Pacific Salmon, 292
Cranial nerves, mixed, epithelioneural associations in ganglia of, 342
Criep, Leo H., Essentials of Allergy, 112
Crossopterygians, 58
Cunningham, Bess V., Psychology for Nurses, 411
Cureton, T. K., *et al.*, Endurance of Young Men, 97
Curie, Eve, Madame Curie: A Biography, 426
Cyclostomes, 34, 43, 65
Cytoplasmic inclusions, of euglenoids, 254
Cysts, of euglenoids, 258

Dahl, Knut, and Sømme, Sven, Salmon Marking in Norway (1938, 1939, and 1940), 196
Dahl, Knut, and Sømme, Olaug Mathisen, The Sexual Maturing of Salmon (Salmo Salar L.), 197
Darlington, C. D., and Ammal, E. K. Janaki, Chromosome Atlas of Cultivated Plants, 279
De Omnibus Rebus et Quibusdem Aliis (book reviews), 130, 218, 323, 424
Deane, L. M., *et al.*, Studies on Brazilian Anophelines from the Northeast and Amazon Regions, 384
deBeer, G. R., 352
Degener, Otto, Plants of Hawaii National Park, 283
Deignan, H. G., The Birds of Northern Thailand, 193
De Jong, H. H., Experimental Catatonia, 210
De Ment, Jack, Fluorochemistry, 103
Desch, Cecil H., Science and the Social Order, 275
Deutsch, Albert, The Mentally Ill in America, 416
Diehl, Harold S., Textbook of Healthful Living, 106
Diet, and thyrotropin, 16
Dougherty, Joseph M., and Lamberti, Anthony J., A Textbook of Bacteriology and Immunology, 403
Dowd, Mary T., and Dent, Alberta, Elements of Foods and Nutrition, 398
Drugs, and thyrotrophin, 16
Dumas, Alexander G., and Keen, Grace, A Psychiatric Primer for the Veteran's Family and Friends, 420
Dunbar, Flanders, Emotions and Bodily Changes, 414
Du Noüy, Lecomte, Studies in Biophysics, 96
Duodenum, epithelioneural associations in, 339
Durham, J. Wyatt, Megafaunal Zones of the Oligocene of Northwestern Washington, 374
Duvall, Evelyn Millis, and Hill, Reuben, When You Marry, 312

Echinoderms, carpoid, 358
Eckstein, Gustav, The Pet Shop, 125
Ecology (book reviews), 74, 275, 370
Economic Botany (book reviews), 88, 188, 285, 381
Economic Zoology (book reviews), 94, 196, 292, 388
Eddy, S., and Hodson, A. C., Taxonomic Keys to the Common Animals of Minnesota, 383
Edelstein, Emma J. and Ludwig, Asclepius: A Collection and Interpretation of the Testimonies, 404
Edge, P. Granville, Vital Statistics and Public Health Work in the Tropics, 128
Elias, Maxim K., Tertiary Prairie Grasses and Other Herbs from the High Plains, 373
Emerson, A. E., The Neotropical Genus Syntermes, 91
Emerson, Arthur I., and Weed, Clarence M., Our Trees: How to Know Them, 381
Endocrine states, and variations in thyrotrophin, 10
Engle, T. L., Psychology, 116
Enogat, John (Ed.), Science News, Vol. I, 425
Environment, changes of external, and thyrotrophin, 19
Epithelioneural bodies, 327
Errington, Paul L., Predation and Vertebrate Populations, 144–177; 221–245
Euglenida, 246
Euglenidae, 264
Everett, Mark R., Medical Biochemistry, 400
Evolution (book reviews), 75, 184, 276, 371
Evolution of early fishes, 33
Ewan, Joseph, University of Colorado Studies (Series D), 87

Faculté de Pharmacie de Nancy, Travaux du Laboratoire de Microbiologie, 203
Farrington, S. Kip, Jr., Interesting Birds of Our Country, 193
Farris, E. J., *et al.*, Animal Colony Maintenance, 94
Farrow, E. Pickworth, (Psycho-)Analyze Yourself, 315
Fei, Hsiao-Tung, Peasant Life in China, 422
Fenichel, Otto, *et al.* (Eds.), The Psychoanalytic Study of the Child, Vol. I, 316
Fenichel, O. The Psychoanalytic Theory of Neurosis, 314
Fennah, R. G., The Fulgoroidea, or Lanternflies, of Trinidad and Adjacent Parts of South America, 90
Finnegan, Susan, Acari, 291
Fish and Wildlife Service, Fishery Resources of the United States, 196
Fishbein, M., The Popular Medical Encyclopedia, 405
Fishbein, Morris (Ed.), Common Ailments of Man, 204
Medical Uses of Soap, 205
Fisher, Walter Kenrick, Echiuroid Worms of the North Pacific Ocean, 383
Fishes, early evolution of, 33
interspecific predation, 223
populations and predation, 221
Fitzpatrick, Frederick L., and Stiles, Karl A., The Biology of Flight, 299
Fixed adults, role of, in origin of vertebrates, 348
Flagella, of euglenoids, 250
Flagellates, euglenoid, cell exterior, 248
life history, 258
red species, 254
Flanders, Stanley E., Control of Sex and Sex-limited Polymorphism in the Hymenoptera, 135–143
Fleming, J. A., *et al.*, Observations and Results in Physical Oceanography, 75
Flint, Richard Foster, Glacial Map of North America, Parts 1 and 2; 375
Flugel, J. C., Man, Morals and Society, 206

Fogg, John M., Jr., Weeds of Lawn and Garden, 89
Ford, Clellan Stearns, A Comparative Study of Human Reproduction, 318
Foster, M. B., and Foster, R. S., Brazil, 187
Frye, T. C., and Clark, Lois, Hepaticae of North America, III, 86
Fulton, John F. (Ed.), Howell's Textbook of Physiology, 200

Galdston, Iago, *et al.*, Modern Attitudes in Psychiatry, 314
Galliformes, wild, populations and predation, 161
Ganglia, mixed cranial nerve, epithelioneural associations in, 342
Gantt, W. Horsley, Experimental Basis for Neurotic Behavior, 120
Garstang, W., 352
Gaskell, W. H., 349
Gatti, Attilio, South of the Sahara, 325
Geiser, Samuel Wood, Horticulture and Horticulturists in Early Texas, 189
General Biology: Philosophy and Education (book reviews), 72, 181, 275, 365
General Physiology (book reviews), 280
General and Systematic Botany (book reviews), 81, 185, 282, 379
General and Systematic Zoology (book reviews), 90, 190, 288, 383
Genetics and Cytology (book reviews), 79, 185, 278, 377
Geoffroy Saint-Hilaire, E., 348
Gerontology, Journal of, 295
Gesell, Arnold, How a Baby Grows, 196
Giabicani, Raymonde, Essais sur la Biologie des Microorganismes, 303
Glomus, aortic, 333
  caroticum, 331
  coccygeal, 333
Glueck, Bernard (Ed.), Current Therapies of Personality Disorders, 416
Goldfrank, Esther S., Changing Configurations in the Social Organization of a Blackfoot Tribe during the Reserve Period, 320
Goldthwait, Joel E., *et al.*, Essentials of Body Mechanics in Health and Disease, 306
Goldzieher, Max A., The Endocrine Glands, 397
Golgi material, of euglenoids, 256
Gonadal states, and thyrotrophin, 13
Goodenough, Florence L., Developmental Psychology, 117
Goodrich, Arthur L., Jr., Birds in Kansas, 386
Goodrich, C., Goniobasis livescens of Michigan, 190
Gould, Sylvester E., Trichinosis, 108
Grant, J. C. Boileau, A Method of Anatomy, 198
Graves, George, Trees, Shrubs, and Vines for the Northeastern United States, 188
Greaves, Joseph E. and Ethelyn O., Elementary Bacteriology, 303
Gregory, W. K., Roles of Motile Larvae and Fixed Adults in the Origin of the Vertebrates, 348–364
Greisheimer, Esther M., Physiology and Anatomy, 297
Grinker, Roy R., and Spiegel, John P., Men under Stress, 206
Grouse, ruffed, 163
Gullet, of euglenoids, 249
Gumpert, Martin, Hahnemann: The Adventurous Career of a Medical Rebel, 205
Gunther, Erna, Ethnobotany of Western Washington, 90
Guthrie, Edwin R., and Horton, George P., Cats in a Puzzle Box, 410

Haggard, H. W., Devils, Drugs and Doctors, 404
Hamilton, W. J., *et al.*, Human Embryology, 293
Hanks, L. M., Jr., and Richardson, Jane, Observations on Northern Blackfoot Kinship, 320
Harper, Francis, Extinct and Vanishing Mammals of the Old World, 93
Harrar, E. S. and J. G., Guide to Southern Trees, 284
Harris, Robt. S., and Thimann, Kenneth V. (Eds.), Vitamins and Hormones, Vol. III, 300
Harvey, H. W., Recent Advances in the Chemistry and Biology of Sea Water, 275
Haury, Emil W., The Excavation of Los Muertos and Neighboring Ruins in the Salt River Valley, Southern Arizona, 126
Hausman, L. A., Field Book of Eastern Birds, 385
Hayes, Ralph W., Trees and Forests of Louisiana, 287
Haynes, William, Southern Horizons, 424
Health and Disease (book reviews), 106, 204, 304, 403
Hematochrome, of euglenoids, 254
Henry, Marguerite, Birds at Home, 290
Henry, Richard J., The Mode of Action of Sulfonamides, 110
Herrell, Wallace E., Penicillin and Other Antibiotic Agents, 111
Hertlein, Leo G., and U. S. Grant IV, The Cenozoic Brachiopoda of Western North America, 76
Hesse, Erich, Narcotics and Drug Addiction, 409
Heterostracans, 40
Hewett, Edgar L., and Dutton, Bertha P. (Eds.), The Pueblo Indian World, 213
Hildebrand, Samuel F., A Descriptive Catalog of the Shore Fishes of Perú, 288
Hill, R. T., Anatomy of the Head and Neck, 296
Hill, Thomas J., A Text-Book of Oral Pathology, 306
Hinsberg, K. (Ed.), Das Geschwulstproblem in Chemie und Physiologie, 204
Hinsie, Leland E., The Person in the Body, 314
Hinton, H. E., A Monograph of the Beetles Associated with Stored Products, Vol. 1, 90
Hirschler, Pierre, Anthropoid and Human Endocranial Casts, 391

Höber, R., Physical Chemistry of Cells and Tissues, 280
Hogeboom, Amy, Birds and How to Draw Them, 291
Honig, P., and Verdoorn, F. (Eds.), Science and Scientists in the Netherlands Indies, 368
Hooton, Earnest, "Young Man, You Are Normal," 198
Hormone, thyrotrophic, 1
Horney, Karen, Our Inner Conflicts, 209
Horsfall, James G., Fungicides and Their Action, 287
Hosaka, Edward Y., Sport Fishing in Hawaii, 91
Hoskins, Margaret M., and Bevelander, Gerrit, Essentials of Histology, 200
Hoskins, R. G., The Biology of Schizophrenia, 415
Howell's Textbook of Physiology, 200
Hubbs, Carl L., Phylogenetic Position of the Citharidae, a Family of Flatfishes, 192
HUMAN BIOLOGY (book reviews), 122, 211, 318, 421
Hume, Edward H., Doctors East, Doctors West, 310
Huntington, E., Mainsprings of Civilization, 178
Hurst, Sir Arthur, Medical Diseases of War, 304
Huszar, G. B. de, Anatomy of Racial Intolerance, 423
Huxley, Aldous, Science, Liberty and Peace, 365
Hymenoptera, 135

Immunity reactions, of euglenoids, 263
Ingestion, by euglenoids, 250
Innes, William T., Exotic Aquarium Fishes, 191
Insectivores, 159
Intercompensations, 229
Ives, Vernon, Turkey, 216

Jack, Homer A., Biological Field Stations of the World, 370
JAHN, THEODORE LOUIS, The Euglenoid Flagellates, 246–274
Jasny, Naum, The Wheats of Classical Antiquity, 286
Johnson, M. L., and Abercrombie, Michael (Eds.), New Biology, 74
Jones, George Neville, American Species of Amelanchier, 284
Flora of Illinois, 82
Jordan, E. O., and Burrows, W., Textbook of Bacteriology, 104
Jossic, Yvonne F. (Ed.), Anatomy of Animals, 295
Journal of Gerontology, 295
Journal of Parenteral Therapy, 116
Jung, Frederic Theodore, and Earle, Elizabeth Carpenter, Anatomy and Physiology, 391

Kaempffert, W., Science Today and Tomorrow, II, 131
Kaplan, Oscar J., Mental Disorders in Later Life, 121
Kardiner, Abram, The Psychological Frontiers of Society, 123
Katz, Louis N., Electrocardiography, 393
Exercises in Electrocardiographic Interpretation, 394
Kauffmann, F., Die Bakteriologie der Salmonella-Gruppe, 105
Keen, A. Myra, and Bentson, Herdis, Check List of California Tertiary Marine Mollusca, 77
Keesing, F. M., Native Peoples of the Pacific World, 320
Kelly, Isabel, The Archeaeology of the Autlán-Tuxcacuesco Area of Jalisco, Part I, 214
Excavations at Culiacán, Sinaloa, 215
Kennedy, Raymond, Bibliography of Indonesian Peoples and Cultures, 320
Kenoyer, Leslie A., and Goddard, Henry N., General Biology, 73
Kerr, Paul F., Tungsten Mineralization in the United States, 326
Keys, T. E., The History of Surgical Anesthesia, 112
King, Robert E., *et al.*, Geology and Paleontology of the Permian Area Northwest of Las Delicias, Southwestern Coahuila, Mexico, 184
Klauber, Laurence M., The Glossy Snake, Arizona, with Descriptions of New Subspecies, 384
Knight, Charles R., Life through the Ages, 276
Kowalevsky, A., 352
Kuck, Loraine E., and Tongg, Richard C., Hawaiian Flowers, 283
Kudo, Richard R., Protozoology, 190
Kuntz, A., The Autonomic Nervous System, 297
Text-Book of Neuro-Anatomy, 296
Kunze, Rudolf, Lecithin, 103
Kupper, Herbert I., Back to Life, 208

Lager, Mildred, The Useful Soybean, 99
Lagomorphs, 154
Landis, Paul H., Adolescence and Youth, 312
Landry, Stuart Omer, The Cult of Equality, 423
Langeron, M., Précis de mycologie, 379
Larvae, Motile, role of in origin of vertebrates, 348
Lecky, Prescott, Self-Consistency, 313
Lennox, William Gordon, Science and Seizures, 416
Leonardo, Richard A., A Surgeon Looks at Life, 205
Levy, Hyman, and Preidel, E. E., Elementary Statistics, 129
Lewis, Nolan D. C., and Pacella, Bernard L., Modern Trends in Child Psychiatry, 316
Lewis, Sir Thomas, Exercises in Human Physiology, 298
Ligue Française contre le Cancer, Le Cancer, 408
Lillie, Ralph Stayner, General Biology and Philosophy of Organism, 181
Lochman, Christina, and Duncan, Donald, Early Upper Cambrian Faunas of Central Montana, 76
Lockley, R. M., Birds of the Sea, 290
Locomotion, by euglenoids, 250
Loeb, Leo, The Biological Basis of Individuality, 70
Logan, Spencer, A Negro's Faith in America, 423
Lorand, S. (Ed.), Yearbook of Psychoanalysis, I, 209
Loveridge, Arthur, Reptiles of the Pacific World, 192
Lower vertebrates, populations and predation, 221
Lowy, Samuel, New Directions in Psychology, 313

Lubberger, Fritz (Ed.), Wahrscheinlichkeiten und Schwankungen, 130
Luck, James Murray, and Hall, Victor E. (Eds.), Annual Review of Physiology, Vol. VIII, 392
Luck, James Murray, and Smith, James H. C. (Eds.), Annual Review of Biochemistry, Vol. XIV, 101
Lungfishes (Dipnoi), 33, 58, 63
Lush, Jay L., Animal Breeding Plans, 292
Lysenko, T. D., Heredity and Its Variability, 279

Macgregor, Gordon, Warriors without Weapons, 319
Macy, Icie G., Nutrition and Chemical Growth in Childhood, Vol. II, 398
Macy, Icie G., and Williams, Harold H., Hidden Hunger, 301
Maher, Frank Thomas, The Reticulo-Endothelial System in Sulfonamide Activity, 111
Main, Rolland J., Synopsis of Physiology, 298
Major, Ralph H., Classic Descriptions of Disease, 404
Maltz, Maxwell, Evolution of Plastic Surgery, 405
Mammals, 145
  non-gliriform, 156
Man, epithelioneural associations in, 336, 343
Marriott, Alice, The Ten Grandmothers, 213
Marshall, Clyde, and Lazier, Edgar L., An Introduction to Human Anatomy, 296
Marshall, F. H. A., and Halnan, E. T., Physiology of Farm Animals, 297
Mason, J. Alden, Costa Rican Stonework, 215
Masserman, Jules H., Principles of Dynamic Psychiatry, 418
Mathematical Tables Project, Table of Arc Sin X, 217
  Tables of Associated Legendre Functions, 218
Mathews, John Joseph, Talking to the Moon, 133
McAtee, W. L. (Ed.), The Ring-Necked Pheasant and Its Management in North America, 292
McClung, L. S., General Bacteriology Laboratory Manual, 403
McCown, Theodore D., Pre-Incaic Huamachuco, 127
McCulloch, E. C., Disinfection and Sterilization, 304
McWilliams, Carey, Southern California Country, 320
Meerloo, A. M., Total War and the Human Mind, 121
Meng, Heinrich, Psyche und Hormon, 318
Meredith, H. V., Physical Growth from Birth to Two Years, I. Stature, 391
Merrill, E. D., Plant Life of the Pacific World, 282
Metschnikoff, E., 352
Mice, 150
Microbiology (book reviews), 104, 203, 302, 402
Millard, Nellie D., and King, Barry G., Human Anatomy and Physiology, 95
Millard, Nellie D., and Showers, Mary Jane C., Laboratory Manual of Anatomy and Physiology, 392
Mitchell, Philip H., A Textbook of Biochemistry, 400
Mitochondria, of euglenoids, 254
Mitosis, in euglenoids, 257
Montagu, M. F. Ashley, An Introduction to Physical Anthropology, 197
  Man's Most Dangerous Myth, 127
Montgomery, Elizabeth Rider, Keys to Nature's Secrets, 325
  The Story Behind Great Medical Discoveries, 306
Moore, Raymond C., and Laudon, Lowell R., Evolution and Classification of Paleozoic Crinoids, 184
Moore, Robert A. (Ed.), Ageing and Degenerative Diseases, 113
Morgan, Banner Bill, Bovine Trichomoniasis, 387
Morgan, John J. B., How to Keep a Sound Mind, 314
Morgan, T. H., 348
Mortality, differential during development, 136
Motile larvae, role of, in origin of vertebrates, 348
Motor responses, of euglenoids, 262
Moulton, Forest Ray (Ed.), A.A.A.S. Research Conference on Cancer, 308
Moyle, John B., and Hotchkiss, Neil, The Aquatic and Marsh Vegetation of Minnesota and Its Value to Waterfowl, 183
Mucus bodies, of euglenoids, 257
Muller, Charles G., and Mazet, Horace S., Tigers of the Sea, 388
Muller, Gulli Lindh, and Dawes, Dorothy E., Introduction to Medical Science, 115
Munroe, Ruth L., Prediction of the Adjustment and Academic Performance of College Students, 414
Murdock, George P., *et al.*, Outline of Cultural Materials, 214
Murine rats, 149
Murrill, Wm. A., A Guide to Florida Animals, 387
  A Guide to Florida Plants, 283
  Historic Foundations of Botany in Florida, 283
  Reptiles Good and Bad, 290
  Trees, 283
Muse, Maude B., Psychology for Nurses, 117
Muskrat, 145
Mustard, Harry S., Government in Public Health, 115

National Cancer Institute, Symposium on Mammary Tumors in Mice, 109
Natural History Society of Jamaica, Glimpses of Jamaican Natural History, 74
Natural selection, 232
Neese, J. H., and Swett, F. H., Introduction to the Medical Sciences for Medical Record Librarians, 116
Neoteny, 358
Nerves, epithelioneural associations in ganglia of mixed cranial, 342
Neuro-entoblastic complexes, 334
Neuro-hepatic complexes, 338
Neuro-mesoblastic complexes, 343
Newburgh, L. H., *et al.*, Some Fundamental Principles of Metabolism, 97
Newman, Frances Burks, The Adolescent in Social Groups, 413

Nichols, John T., and Bartsch, Paul, Fishes and Shells of the Pacific World, 288
Nickles, John M., *et al.*, Bibliography and Index of Geology Exclusive of North America, Vol. 10—1943–1944; 371
Nimuendajú, Curt, The Eastern Timbira, 421
Non-gliriform mammals, 156
Nord, F. F., and Werkman, C. H. (Eds.), Advances in Enzymology and Related Subjects of Biochemistry, Vol. V, 401
Norris, K. R., Experimental Determination of the Influence of the Red-legged Earth Mite on a Subterranean Clover Pasture in W. Australia, 371
Novikoff, Alex, Climbing Our Family Tree, 75
Nuclear structure, of euglenoids, 257
Nutrition, embryonic, and sex-limited polymorphism, 141
heterotrophic, of euglenoids, 261
holozoic, of euglenoids, 261
phototrophic, of euglenoids, 260
post-embryonic, and sex-limited polymorphism, 142

Oberholser, Harry C., Birds of the White-Fuller Expedition to Kenya, East Africa, 290
Oberndorf, Clarence P., The Psychiatric Novels of Oliver Wendell Holmes, 208
O'Neill, John J., You and the Universe, 368
Oppenheimer, Jane, Essentia Non Sunt Multiplicanda Praeter Necessitatem, 70
Orgel, Samuel Zachary, Psychiatry Today and Tomorrow, 416
Origin of vertebrates, 42, 348
Osteichthyes, 33, 34, 58, 65
Ostracoderms, 35, 355
Oviposition, differential responses, 138
preferential sites, 138
rate of, 139

Palmella stages, of euglenoids, 258
Pancreas, sympathetico-insular complexes of, 334
Pancreatic islet states, and thyrotrophin, 16
Paraganglia, 328
Paramylum, of euglenoids, 253
Parasites, of euglenoids, 263
Parasitology (book reviews), 291, 387
Parathyroid states, and thyrotrophin, 16
Park, Orlando, Further Studies in Pselaphidae (Coleoptera) of Mexico and Guatemala, 91
Parker, Bertha Morris, Saving Our Wildlife, 74
Parker, Bertha Morris, and Frank, Orlin D., Plant Factories, 87
Parry, J. W., The Spice Handbook, 189
Parsons, Elsie Clews, Peguche, Ecuador, 319
Patten, Bradley M., Human Embryology, 389
Patten, Wm., 349
Peake, Harry C., Practical Dog Breeding, 185
Pearse, Innes H., and Crocker, Lucy H., The Peckham Experiment, 322
Pearson, Frank A., and Harper, Floyd A., The World's Hunger, 202
Pediatrics, Quarterly Review of, 405
Pennsylvania War Services Project, W.P.A., Grapes, 89
Peranemidae, 264
Peters, J. L., Check-List of Birds of the World, V, 194
Pettingill, Olin Sewall, Jr., A Laboratory and Field Manual of Ornithology, 385
Pharyngeal rod apparatus, of euglenoids, 250
Pheasant, ring-necked, 165
Phillips, Ralph W., *et al.*, The Livestock of China, 95
Phylogeny, of euglenoid flagellates, 266
of fishes, 33
Pig, epithelioneural associations in, 342
Pigman, W. W., and Wolfrom, M. L. (Eds.), Advances in Carbohydrate Chemistry, Vol. I, 102
Pilger, R., Angiospermae: Reihe Glumiflorae, Gramineae III (Unterfamilie Panicoideae), 87
Pistorius, Anna, What Bird Is It? 193
Pituitary, thyrotrophic hormone of, 1
Pituitary states, and thyrotrophin, 10
Placoderms, 46, 357
Plant Physiology (book reviews), 87, 381
Pliny, Natural History, XII–XVI, 381
Pocock, R. I., *et al.*, Wonders of Nature, 371
Podolsky, Edward, Doctors, Drugs and Steel, 310
Pollack, Philip, Careers in Science, 132
Polyembryony, differential proclivity of sexes, 140
Polymorphism, sex-limited, 135, 140
Predation, and intercompensations, 229
and natural selection, 232
and territoriality, 227
and variable factors, 228
and vertebrate populations, 144, 221
interspecific, on fishes, 223
Pre-mating interval following emergence, 137
Primates, 158
Prochordates (lower chordates), 42, 355
Psychology and Animal Behavior (book reviews), 116, 205, 311, 410
Pyrenoids, of euglenoids, 253

Quail, bobwhite, 169
Quarterly Journal of Studies on Alcohol: Alcohol, Science and Society, 323
Quarterly Review of Pediatrics, 405
Questel, Adrien, The Flora of the Island of St. Bartholomew (French West Indies) and Its Origin, 84
Quiring, Daniel P., *et al.*, The Extremities, 296

Rabinowitch, Eugene I., Photosynthesis and Related Processes, Vol. I, 100
Rackham, H. (Translator), Pliny: Natural History, 381

Rahn, Otto, Injury and Death of Bacteria by Chemical Agents, 105
Microbes of Merit, 304
Rand, A. L., Mammals of Yukon, Canada, 291
Raper, Howard Riley, Man Against Pain, 307
Raphael, Max, Prehistoric Cave Paintings, 125
Rasmussen, Andrew Theodore, The Principal Nervous Pathways, 199
Ratcliff, J. D. (Ed.), Science Year Book of 1946, 323
Ratner, Bret, Allergy, Anaphylaxis and Immunotherapy, 111
Rats, murine, 149
Rauth, Rev. J. Edward, and Sheehy, Sister M. Maurice, Principles of Psychology for the Basic Course in Nursing, 411
Rayner, M. C., Trees and Toadstools, 84
Rayner, M. C., and Neilson-Jones, W., Problems in Tree Nutrition, 88
Rees, J. R., The Shaping of Psychiatry by War, 122
Reese, Hans H., *et al.* (Eds.), The 1944 Year Book of Neurology, Psychiatry and Endocrinology, 205
Reik, Theodor, Psychology of Sex Relations, 210
Reinhart, Phillip W., Mesozoic and Cenozoic Arcidae from the Pacific Slope of North America, 77
Reis, Rev. R. H., S.J., Manual of Frog and Chick Development, 293
Reproduction, of euglenoids, 258
Reproductive activity, and variations in thyrotrophin, 7
Reservoir, of euglenoids, 249
Respiration, of euglenoids, 261
Reynolds, Reginald, Cleanliness and Godliness, 409
Ribot, T. A., The Psychology of Attention, 311
Rijn, J. J. L. van, Die Glykoside, 301
Ring-necked pheasant, 165
Ritchie, A. D., Civilization, Science and Religion, 72
Rodenhouse, Irma Zintheo, and Guberlet, John E., The Morphology and Behavior of the Cushion Star Pteraster tesselatus Ives, 383
Rodent populations, 145
Roe, R., and Allen, G. H., Studies on the Mitchell Grass Association in South-Western Queensland, Part 2, 183
Róheim, Géza, The Eternal Ones of the Dream, 210
Role of fixed adults in origin of vertebrates, 348
Romer, Alfred Sherwood, The Early Evolution of Fishes, 33–69
Romer, Alfred Sherwood, Vertebrate Paleontology, 78
Ross, Edward S., and Roberts, H. Radclyffe, The Mosquito Atlas, Parts I and II, 190
Rouleau, Ernest, Bibliographie des Travaux Concernant la Flore Canadienne, Parus dans "Rhodora," de 1899 à 1943 Inclusivement, 285
Rousseau, Jacques, L'Hérédité et l'Homme, 80
Rudin, Sol M., and Greenleaf, Peter, Biology Laboratory Notebook, 369
Ruffed grouse, 163
Russell, E. S., The Directiveness of Organic Activities, 181
Russell, Paul F., *et al.*, Keys to the Anopheline Mosquitoes of the World, 190

Saint-Hilaire, A. de, Esquisse de Mes Voyages au Brésil et Paraguay, 381
Samec, M., Die neure Entwicklung der Kolloidchemie der Stärke, 402
Sandin, Adolph A., Social and Emotional Adjustments of Regularly Promoted and Non-Promoted Pupils, 318
Sandow, Alexander, The Effect of Activity on the Latent Period of Muscular Contraction, 97
Schneider, Nina and Herman, Let's Find Out, 325
Schoen, Max, Human Nature in the Making, 312
Schultz, T. W. (Ed.), Food for the World, 201
Schwartz, Charles W., The Ecology of the Prairie Chicken in Missouri, 75
Schwartz, Louis, and Peck, Samuel M., Cosmetics and Dermatitis, 406
Scott, William B., The Mammalia of the Duchesne River Oligocene, 79
Seitz, Franz, Vitamine und Hormone, Part II, 300
Seliger, Robert V., Alcoholics are Sick People, 120
Selye, Hans, Encyclopedia of Endocrinology, Section IV, Vol. VII, 397
Semper, C., 349
Sevag, M. G., Immuno-Catalysis, 104
Sex, control of: by differential mortality, 136
by differential oviposition responses, 138
by differential polyembryonic proclivity of sexes, 140
by preferential sites of oviposition, 138
by pre-mating interval after emergence, 137
by rate of oviposition, 139
in Hymenoptera, 135
mechanisms of, 135
Sex, in euglenoids, 259
Sex, and variations in thyrotrophin, 7
Sex-limited polymorphism in Hymenoptera, 135, 140
influence of embryonic nutrition on, 141; of post-embryonic nutrition on, 142
Shacter, Helen, Understanding Ourselves, 421
Shapley, H., *et al.* (Eds.), A Treasury of Science, 324
Sheehan, J. Eastman, General and Plastic Surgery, 405
Sherman, H. C., Chemistry of Food and Nutrition, 399
Sherman, Mandel, Intelligence and Its Deviations, 118
Sigerist, H. E., The University at the Crossroads, 367
Simmons, Leo W., The Role of the Aged in Primitive Society, 212
Simpson, George Gaylord, The Principles of Classification and a Classification of Mammals, 194
Smart, Mollie Stevens, and Smart, Russell Cook, It's a Wise Parent, 117
Smillie, Wilson G., Preventive Medicine and Public Health, 410
Smith, Clement A., The Physiology of the Newborn Infant, 96
Smith, George, An Introduction to Industrial Mycology, 382

Smith, Hobart M., Handbook of Lizards, 289
Smith, Hobart M., and Taylor, Edward H., An Annotated Checklist and Key to the Snakes of Mexico, 93
Smith, Hugh M., The Fresh-Water Fishes of Siam, or Thailand, 288
Smith, James G., and Duncan, Acheson J., Sampling Statistics and Applications, 216
Smith, Roger C., Guide to the Literature of the Zoological Sciences, 387
Smithsonian Institution, Annual Report, 427
Snedecor, George W., Statistical Methods, 323
Snyder, Laurence H., The Principles of Heredity, 278
Sommers, Vita Stein, The Influence of Parental Attitudes and Social Environment on the Personality Development of the Adolescent Blind, 119
Sorsby, Arnold, Medicine and Mankind, 114
Soskin, Samuel, and Levine, Rachmiel, Carbohydrate Metabolism, 393
Stade, Gerhard, and Staude, Herbert, Mikrophotographie, 132
Stearn, E. Wagner and Allan E., The Effect of Smallpox on the Destiny of the Amerindian, 211
Steincrohn, Peter J., What You Can Do for Angina Pectoris and Coronary Occlusion, 407
Stern, B. J., Medical Services by Government, 410
Medicine in industry, 310
Stern, Rudolf A., Trauma in Internal Diseases, 112
Stieglitz, E. J., A Future for Preventive Medicine, 309
Stigma, of euglenoids, 253
Strecker, Edward A., Fundamentals of Psychiatry, 206
Strecker, Edward A., and Appel, Kenneth E., Psychiatry in Modern Warfare, 206
Sumner, Francis B., The Life History of an American Naturalist, 218
Sutherland, Louis, The Life of the Queen Bee, 288
Swanson, G., *et al.*, The Mammals of Minnesota, 195
Sympathetico-insular complexes of pancreas, 334

Taylor, Hugh Stott, *et al.*, Molecular Films, the Cyclotron, and the New Biology, 324
Taxonomy, of Euglenida, 264, 265
Taylor, Norman, Cinchona in Java, 90
Teagarden, Florence M., Child Psychology for Professional Workers, 413
Temkin, Owsei, The Falling Sickness, 113
Territoriality, 227
Thiel, A., *et al.*, Taschenbuch für die Lebensmittelchemie, 402
Thom, Charles, and Raper, Kenneth B., A Manual of the Aspergilli, 85
Thomas, Gertrude I., The Dietary of Health and Disease, 99
Thomas, Henry and Dana Lee, Living Biographies of Great Scientists, 370
Thompson, Warren S., Population and Peace in the Pacific, 424
Thorndike, Lynn, and Benjamin, Francis S., Jr. (Eds.), The Herbal of Rufinus, 285
Thyroid states, and thyrotrophin, 11
Thyrotrophin, 1
assay methods, 2
comparative potency in animals, 5
in hypo- and hyper-adrenal states, 15
in hypo- and hyper-gonadal states, 13
in hypo- and hyper-pancreatic islet states, 16
in hypo- and hyper-parathyroid states, 16
in hypo- and hyper-pituitary states, 10
in hypo- and hyper-thyroid states, 11
methods of demonstrating presence of, 1
variations in, related to: age, sex, reproductive activity, 7; changes of external environment, 19; diet, drugs, toxins, 16; endocrine states, 10
Tinker, Spencer Wilkie, Hawaiian Fishes, 288
Todd, Ramona L., and Freeman, Ruth B., Health Care of the Family, 309
Townes, Henry K., Jr., The Nearctic Species of Tendipedini, 191
Toxins, and thyrotrophin, 16
Tryon, Henry H., The Management of Young Volunteer Hardwood Stands, 190
Tunnicliffe, C. F., Wonders of Nature, 371

Ungulates, 156
Urbach, Erich, Skin Diseases, Nutrition and Metabolism, 406

Vacuome, of euglenoids, 255
Van Campenhout, E., The Epithelioneural Bodies, 327–347
Van Name, Willard G., The North and South American Ascidians, 191
van Rijn, J. J. L., Die Glykoside, 301
Vaughan, T. W., American Old and Middle Tertiary Larger Foraminifera and Corals, Part I, 276
Vaughan, T. W., and Wells, J. W., Revision of the Suborders, Families, and Genera of the Scleractinia, 371
Verdoorn, Frans (Ed.), Plants and Plant Science in Latin America, 81
Verrier, Marie-Louise, Biologie de la Vision, 394
Verrill, A. Hyatt, Strange Customs, Manners and Beliefs, 421
Vertebrate populations, 144, 221
Vertebrates, origin of, 42, 348
Villa R., Alfonso, The Maya of East Central Quintana Roo, 319
Vincke, Erich, Vitamine und Hormone, Part III, 300
Vokes, Harold E., Supraspecific Groups of the Pelecypod Family Corbulidae, 185
von Bonin, Gerhardt, The Cortex of Galago, 95
von Brand, Theodor, Anaerobiosis in Invertebrates, 281

Waldeck, Jo Besse McElveen, Jungle Journey, 422

Walker, Kenneth, The Physiology of Sex, 420
Wall, Francis P., and Zeidberg, Louis D., Health Guides and Guards, 409
Wanless, H. R., Pennsylvanian Geology of a Part of the S. Appalachian Coal Field, 372
Warner, W. Lloyd, and Srole, Leo, The Social Systems of American Ethnic Groups, 124
Washburn, Ruth Wendell, Re-education in a Nursery group, 318
Waterhouse, D. F., Studies of the Physiology and Toxicology of Blowflies, Parts 10 and 11, 300
Wattenwyl, Hubert von, Tierexperimentelle Untersuchungen über die Wirkung langdauernder Follikelhormonapplikation und die hormonale Tumorentstehung, 200
Weaver, Charles E., Stratigraphy and Paleontology of the Tertiary Formations at Coos Bay, Oregon, 372
Weidenreich, Franz, Gaint Early Man from Java and South China, 375
Wells, John West, American Old and Middle Tertiary Larger Foraminifera and Corals, Part II, 276
Whitby, M., Theory of Life, Diseases and Death, 403
White, M. J. D., Animal Cytology and Evolution, 377
Wiener, Peter F., German for the Scientist, 424
Williams, Jesse Feiring, Personal Hygiene Applied, 409
Williams, Roger J., What to Do About Vitamins, 202
Williamson, A. A., Evolution: The Quantitative Principles of Progress, 377
Wilson, Charles Morrow (Ed.), New Crops for the New World, 88
Winton, Andrew L., and Winton, Kate Barber, Analysis of Foods, 202
Wodehouse, Roger P., Hayfever Plants, 86
Wolberg, Lewis R., Hypnoanalysis, 419
Wolfenbarger, D. O., Dispersion of Small Organisms, 370
Worden, Felice, The Sketch Book of Dogs, 93
Worley, Leonard G., The Golgi Apparatus, 279

Yang, Martin C., A Chinese Village, 215
Yocum, L. Edwin, Plant Growth, 87
Young, J. H., Caesarian Section, 113

Zaidenberg, Arthur, Anyone Can Draw Animals, 392
Zirkle, Conway, The Early History of the Idea of the Inheritance of Acquired Characters and of Pangenesis, 378
ZoBell, Claude E., Marine Microbiology, 302
Zworykin, V. K., *et al.*, Electron Optics and the Electron Microscope, 325